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Primary 4
2nd Term

Vehicles and fuel

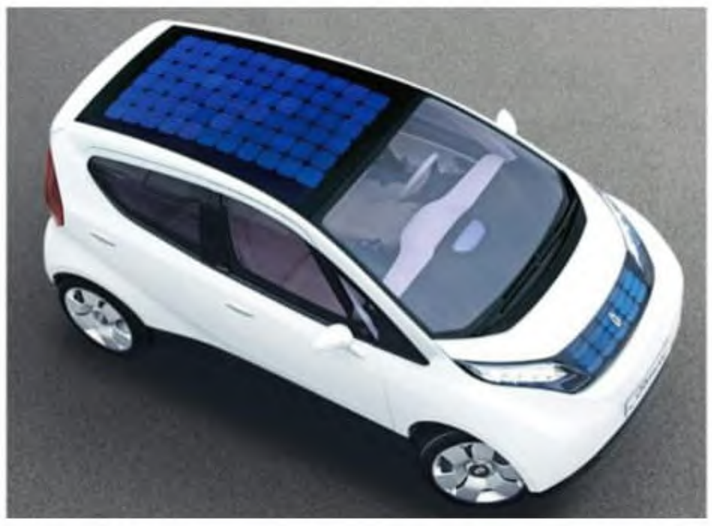
Mechanical engineers think about how **energy can be used to operate cars** in creative ways **some cars using fuel** and **some electricity**, but these cars have **many disadvantages**

	Fuel vehicles	Electric vehicles
POC		
Disadvantages	It requires going to the **gas station** that **affects climate change**.	They **contain batteries** that must be **charged.**

Can Imagine a car that never stops due to gasoline or charging?

Mechanical engineers design vehicles that operated by using solar energy only.
They trying to make solar vehicles that can be driven as quickly as conventional vehicles.
They reduce weight of the car and effective changes.

Do solar vehicles have advantages and disadvantages?



Advantages	Disadvantages
Don't need fuel	The amount of energy from the sun is not as great as the amount of energy we get from gasoline or electricity.
Don't need charge	
Don't cause climate change	

What happens to objects when they collide with other objects?

When two objects collide with each other, each object pushes or crashes the other this called collision.

Collision: It is crashing or bumping two objects into each other that causes damage.

Examples of Collision

1. Collision in cricket game

The cricket player stands with a bat and moves it as the ball approaches at high speed.

The bat transfers its kinetic energy to the ball. So, the speed of the ball increases in a different direction.

2. The wrecking ball

Knocks down buildings, helps construction workers knock down the walls or parts of buildings.

3. Train collides car

When a fast train that has heavy mass and more energy collides with a car that has light mass and less energy, the energy transfers from train to the car damaging it.

Notes

1. An object with more energy causes more damage than an object with low energy.
2. A heavier object causes more damage than a lighter object.

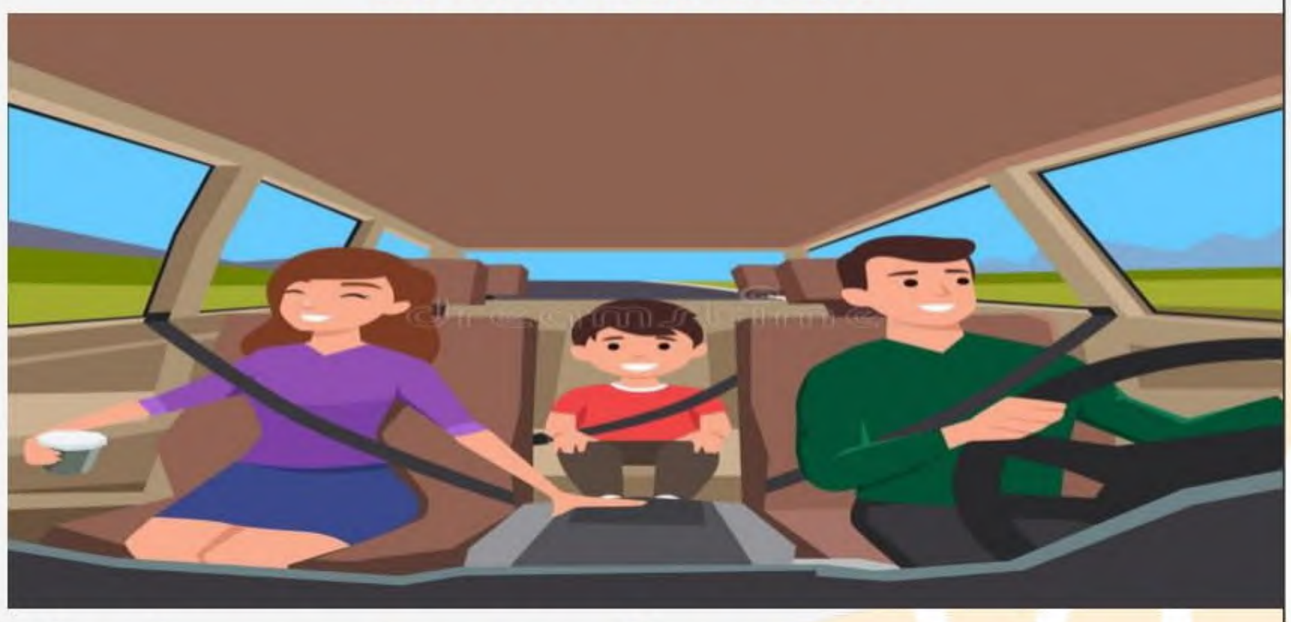
What happens to objects when they collide with other objects?

Objects collide

When you drive a car, then it stops suddenly, **your body moves forward**.
So, we need **safety equipment** to keep us in our places in case of car collision.

Car's Safety equipment

1. Car seatbelts



The importance of car seatbelts:

They are used in cars to keep our bodies from moving forward.

They have saved thousands of lives.

2. Air Bag

- **Its function:**

-Absorbs the energy of the car's collide
-Slows the speed of person moving forward.

- **Its Location:**

Folded into Steering wheel, seat, dashboard, or door

- **Its composition:**

Made from thin nylon material.

How does it work?

1. During collision the car sensor detect a crash, the air bag inflates automatically.
The air bag fills with gas to provide a soft cushion.
2. After collision It deflates through its holes or vents, so we can get out of the car.
Air bag deflates as fast as inflates.

Example: A bike is running down the street hits a traffic sign.

1. The bike has a kinetic energy during running.
2. When the bike hits the sign, the kinetic energy of the bike will be transferred to the sign and the bike stops.
3. Potential energy that stored in the sign changes into kinetic energy may make the sign vibrates.
4. Some of kinetic energy changes into sound energy.

Explanation

1. The effect of speed on collision

1. The amount of kinetic energy of an object depends on its speed, the faster an object travels, the more kinetic energy it has.

2. When a fast object collides another object. Energy transfers to another object, some of the transferred energy is in the form of heat, light, or sound.

The greater the speed of a moving object, the greater the kinetic energy in the collision.

The difference between the fast object and slow object during collision. If a car increases its speed, its kinetic energy increases.

Fast objects	Slow objects
Have much energy when collision occurs, they act more forced and cause more damage -This force can -Smash a car fender	Have less energy When collision occur, they act less force and cause less damage compared to the fast object

If two cars collided head-on with each other, then the force act on the accident depends on the combined speed of both cars.

The relationship between speed and kinetic energy

As the object's speed increases, its kinetic energy increases (direct relation)

1. Fast object has high kinetic energy causes more damage.
2. Slow object has low kinetic energy causes less damage.

Example:

Try to throw the clay ball using different amount of forces.

Amount of force used	Observation
1. Dropped	the shape of the ball changes slightly and becomes uneven after dropping.
2. Thrown Slightly	the shape of the ball changes more and becomes uneven after throwing it with small force
3. Thrown Hard	the shape of the ball changes much more and becomes completely uneven after throwing it with more force

The relationship between mass and kinetic energy

There is relationship between mass and kinetic energy, As the object's mass increases, its kinetic energy increases.

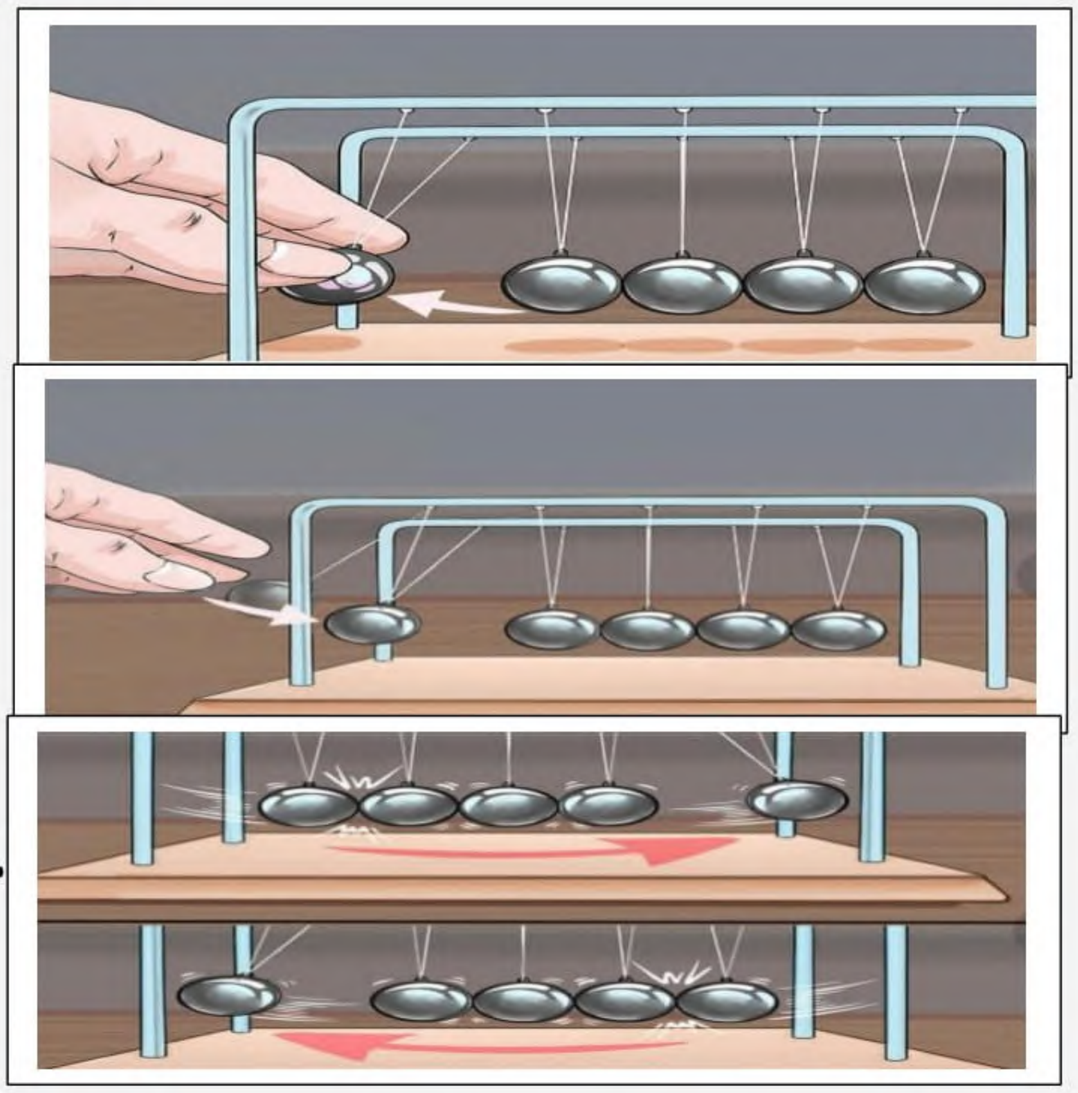
Heavy objects have high kinetic energy causes more damage.
light objects have low kinetic energy causes less damage.

The effect of mass on collision

If a bicycle (light object) moving with a speed 50km/hr hits a person (Pedestrian) , the person may get injured only and will survive.

If a car (heavy object) moving with a speed 50km/hr hits a person (Pedestrian), the person's life may be in danger.

Newton's cradle



1. When the pendulum ball is raised up, it stores a potential energy.
2. When the ball is left to move in the direction of the rest of balls, the potential energy decreases gradually and changes into kinetic energy.
3. When the balls collide the amount of the kinetic energy transfers to the second ball during collision and reaches the last ball.
4. When the energy reaches the last ball, it moves with a kinetic energy equals to the kinetic energy of the first ball.

None of the energy disappears but changes into different forms

1. Changing some of kinetic energy into sound energy
2. Some is lost in the form of friction between the string and other moving parts.
3. A little energy is lost as the balls pass through the air.

The energy before the collision is equal after collision and none of them disappear but changes from one form to another.

If you leave the cradle long enough, after lots of collisions, the moving balls lose their kinetic energy and stop.

Q: If a car hits a stop sign, not all the energy transfers from the car to the sign?

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The relationship between mass of object and its speed and kinetic energy

The greater the mass of an object, the greater its speed.

The greater the mass of a moving object, the greater its kinetic energy.

The truck speed = 80 Km/h

It consumes more fuel and gains more kinetic energy

The car speed = 80 Km/h

It consumes less fuel and gains less kinetic energy

Explanation

The large truck has a greater mass than a car.

Truck needs bigger engines than car.

As each vehicle moves faster, the energy from the fuel which its engine uses is converted into kinetic

A 1-ton truck has half the kinetic energy of a 2-ton truck travelling at the same speed.
Because, if the mass of an object doubles, its kinetic energy at a certain speed double.
The big truck consumes more fuel than the car and gains more kinetic energy

Notes:

1. If a car hits a cup, The distance covered by the cup increases as the mass of the car that hits it increases.
2. The speed and kinetic energy of objects increases with increase in their mass.

Collision Investigation Police

1. How does a crash investigator deal with collision?

1) A crash investigator deals with a car crash as a puzzle to solve the puzzle, he uses all scientific laws of motion, force, and energy.

3) He asks the two drivers to know who caused the accident.

2.Accident Investigator Tasks

(A) Take measurement of accident scene.

1- He measures the damage of the two cars and their position after collision (Where they ended up after collision).

2- He uses photos and videos to collect all needed information about the accident instead of taking measurement at the scene directly.

3- The two cars stored for close inspection.

(B) Collecting data

1- He knows the acting force on the car.

2- He measures the car mass by using a scale.

3- He uses references material that the manufacture company supplies.

4. They compare the cars from the crash to data the manufactures supply.

4- This comparison helps them know how much force was involved in the crash.

Note: When the mass of the car increases, the time taken to cross the distance to the finish line decreases, and the speed of the moving object increases. So, the speed of the moving object increases as its mass.

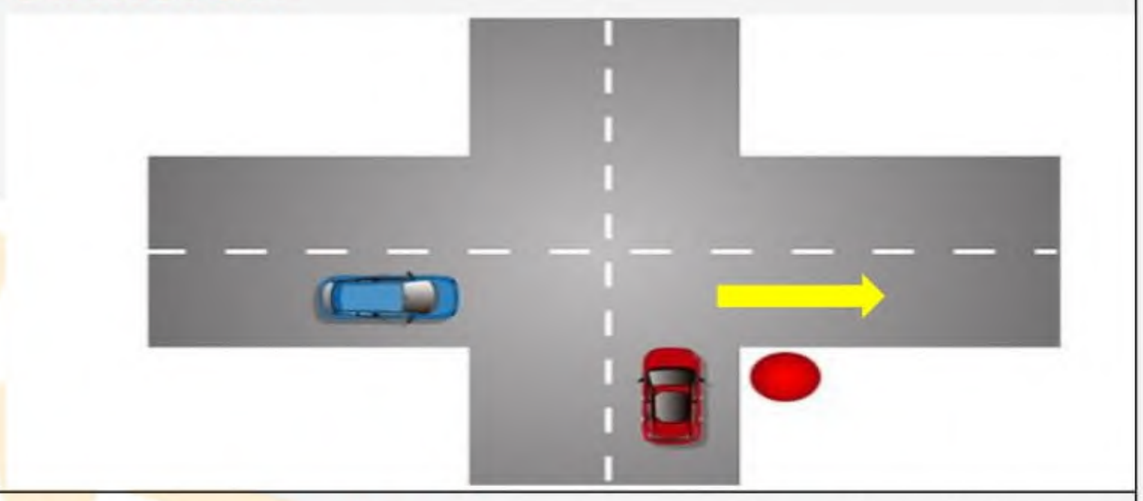
3. Crash Site Scenario: The following figures are done by a crash investigator showing diagrams of two cars before collision of two accidents from different direction.

Types of collision

Head-on- The front collision

1. The **red car** is driving toward the intersection legally.
2. The **blue car** is driving in **the wrong way** (lane).
3. The cars are **heading** toward each other.
4. **The blue car was speeding, while the red car was below the speed limit.**
5. **The arrow** indicates the direction of **the red car** after collision.

T-bone collision - The Side collision



1. The red car is moving inside the intersection from a stop line,
2. The **blue car** continued in a **straight line.**
3. The **blue car** hits the **red car**.
4. Both has **the same mass**
5. **The arrow** indicates **the red car** direction after collision

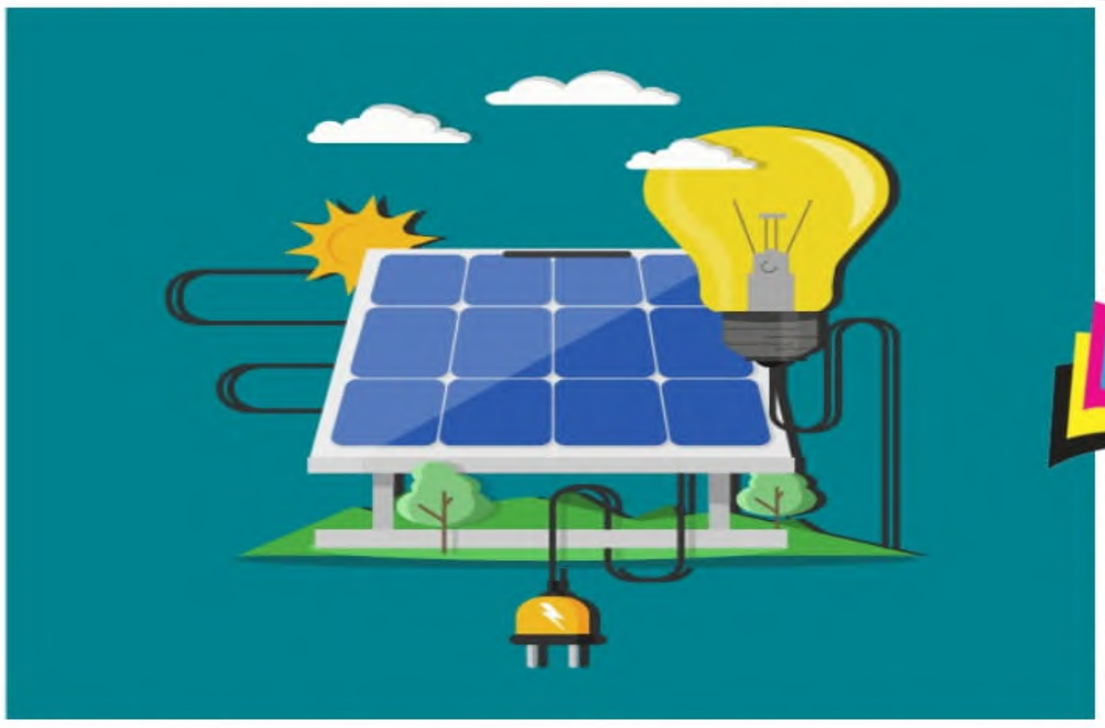
Devices and Energy

Activity (1): What kinds of energy transfer must occur for light from the sun to power a cell phone?

Technology can help us turn **light energy** from the sun into **different forms of energy** that can help power a cell phone

Sun provides us different types of energy such as nuclear, light and heat energies.

Example: Solar panels **convert** solar energy into electrical energy to power or charge our phones.



Mention the forms of energy transformation from sun to operate cell phones

Complete the following table

Illustrations	Energy used Energy input	Energy produced Energy output
		
		
		

Technology helps us to convert the light energy that comes from sun to different forms such as thermal and electric energy.

Examples

1. Solar water heater	2. Solar cells
	
is a device that **converts light or solar energy to thermal energy to heat water for bath and shower.**	is a device that **converts light energy to electric energy to light house and charge devices.**

Activity 2 Energy in Remote-Controlled Car

Every day you may use devices that need **energy** to work.
Have you ever thought about where that energy comes from?

Many toys can be operated remotely.

Such as

1. Remote-controlled cars
2. trucks
3. planes
4. boats
5. Drones

All these devices need energy to make them move and do tasks such as turning corners, moving remote arms, or operating cameras.

How do remote-controlled toys get their energy?

All of these devices **use batteries** as a power source (Chemical energy is converted into electricity).
When the batteries are **exhausted** or **run out charge**, they must be:

1. recharged (Plug the device)

2. Replaced with new ones.

Remember that ... Many of the devices we use every day **need some type of energy to work**. These devices can **transform this energy into other forms of energy**. For example, **chemical energy** in a battery is **transformed into electrical energy** to run a remote-controlled car.

Activity 3: Mars Rover Curiosity

3. Humans have sent many missions to Mars

- **People** — None of these missions included people
- **Robots** — They all used different types of remotely operated vehicles or robots

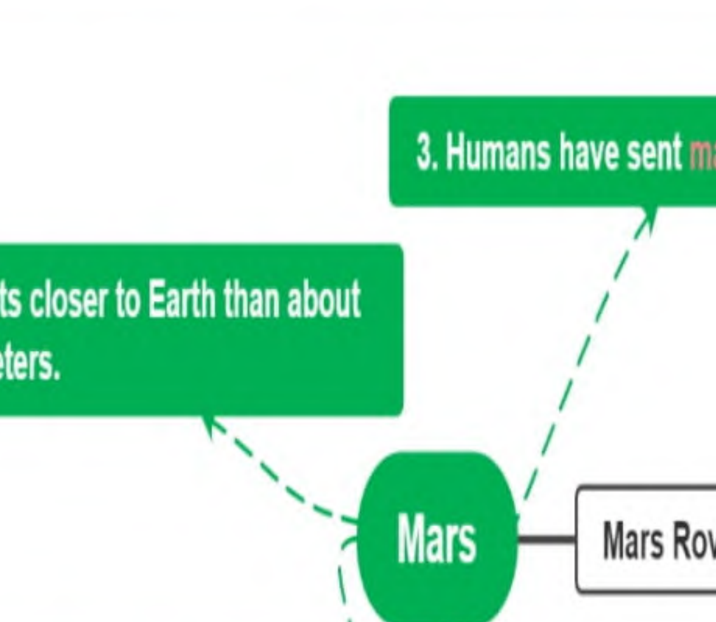
1. Mars never gets closer to Earth than about 54 million kilometers.

2. It takes a spacecraft about six months, usually longer, to get there.

Mars

Mars Rover

- Curiosity is one of the most famous **car-sized robots** is used **to explore the surface of Mars**
- Curiosity is a **robot operated by remote control** and **needs a source of energy.**
- Curiosity uses a **long-term battery** and **solar cells** as a source of energy.



The Ways of Vehicles rover use energy

1. Like **remote-controlled** toys, these Rovers need **energy** to explore Mars.
2. They can't plug.
3. They can't change batteries as in found in toys.
4. Use long-term batteries and solar cells to convert **solar energy** into **electrical energy** to work.

What energy sources could they use?

Curiosity converts Solar energy to electric, kinetic, and thermal energy to work sensory systems

Activity 5: What Do You Already Know About Devices and Energy? let's think about these devices when they are in use. How does the energy change?

Illustration	Energy input	Energy output
 Hair dryer	Electric energy	Thermal Energy Sound Energy Kinetic Energy
Curiosity rover 	Solar Energy	Electric Energy Kinetic Energy Thermal Energy
 Washing machine	Electric Energy	Thermal energy Kinetic energy Sound energy

 **Remote control car**	**Chemical Energy**	**Kinetic Energy**
 **Cloth machine**	**Electric Energy**	**Kinetic Energy** **Thermal Energy** **Sound Energy**

What is the source of energy, or energy input, for each device?

What is the energy output?

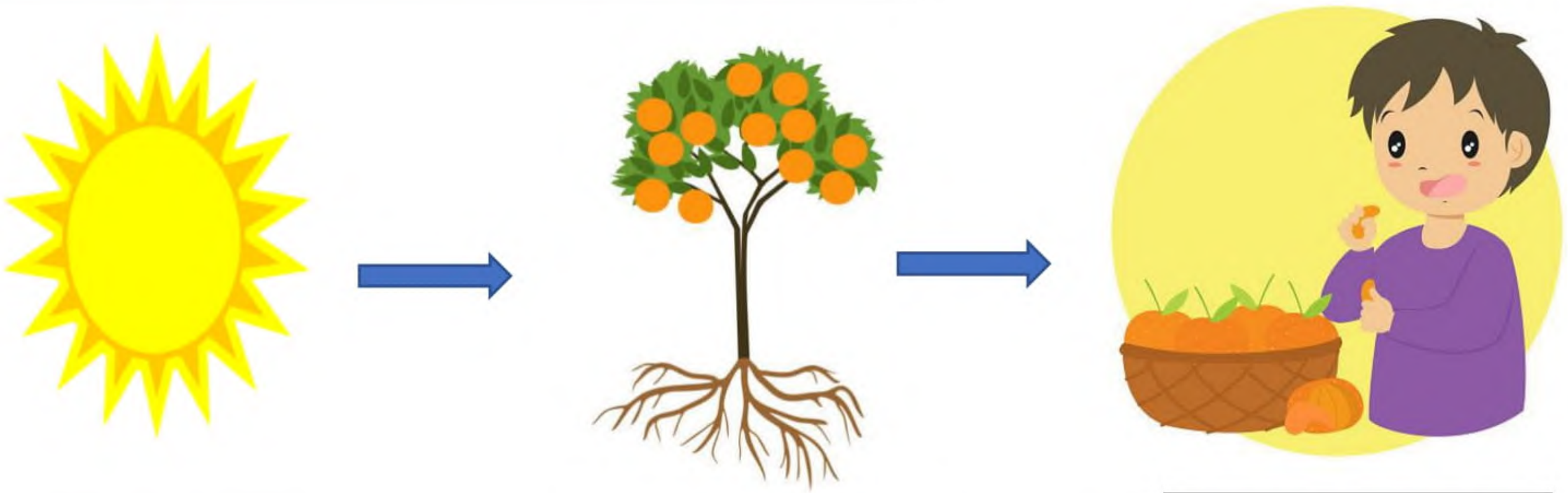
1.Bike 2. Phone: 3. Saw

Activity 5: **Energy Chains**: How would you trace energy from its source to a device in use?

The sun produces most forms of energy we use in our daily life. Most energy we use is made inside the **sun**

To know **how energy gets inside the device we use**. We can draw energy chains that show **the path of energy** from **the sun** to different **devices**.

The energy chain for eating an orange



Light Energy → Chemical Energy → Kinetic Energy

This **energy chain** starts with energy from the sun hitting the Earth as light. A plant, such as an **orange tree**, transforms that **light energy** into stored **Chemical energy** as it makes sugars. When you eat the orange, your body uses the chemical energy to move.

The chemical energy stored inside the food converts into kinetic energy.

The energy chain for heating a pan of water over a fire

Light Energy → Chemical Energy → Thermal Energy → Thermal Energy

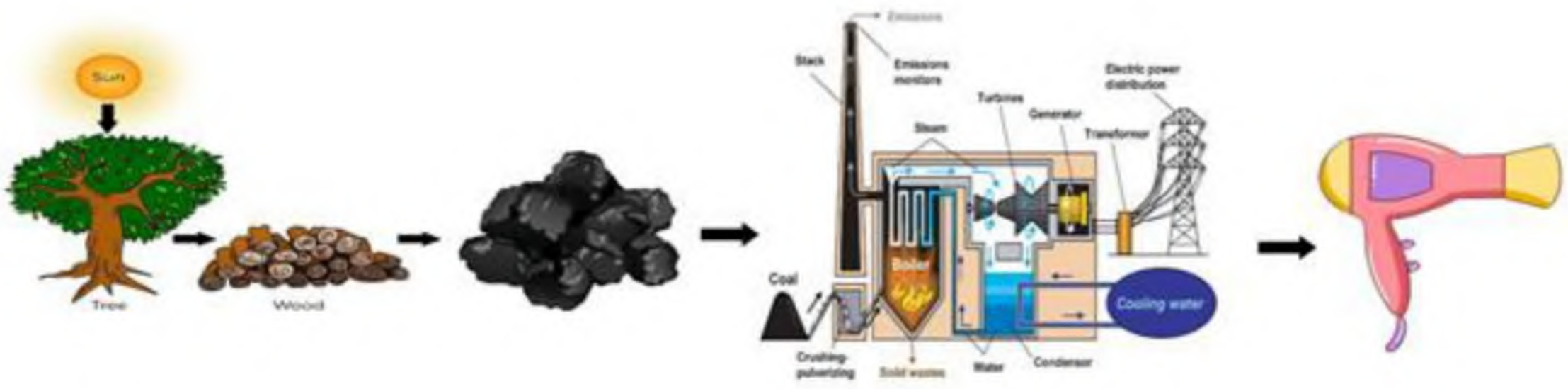
Energy from the sun is stored in the tree's wood as a chemical energy to grow up, when we burn the wood produced heat energy to heat water or cook food.

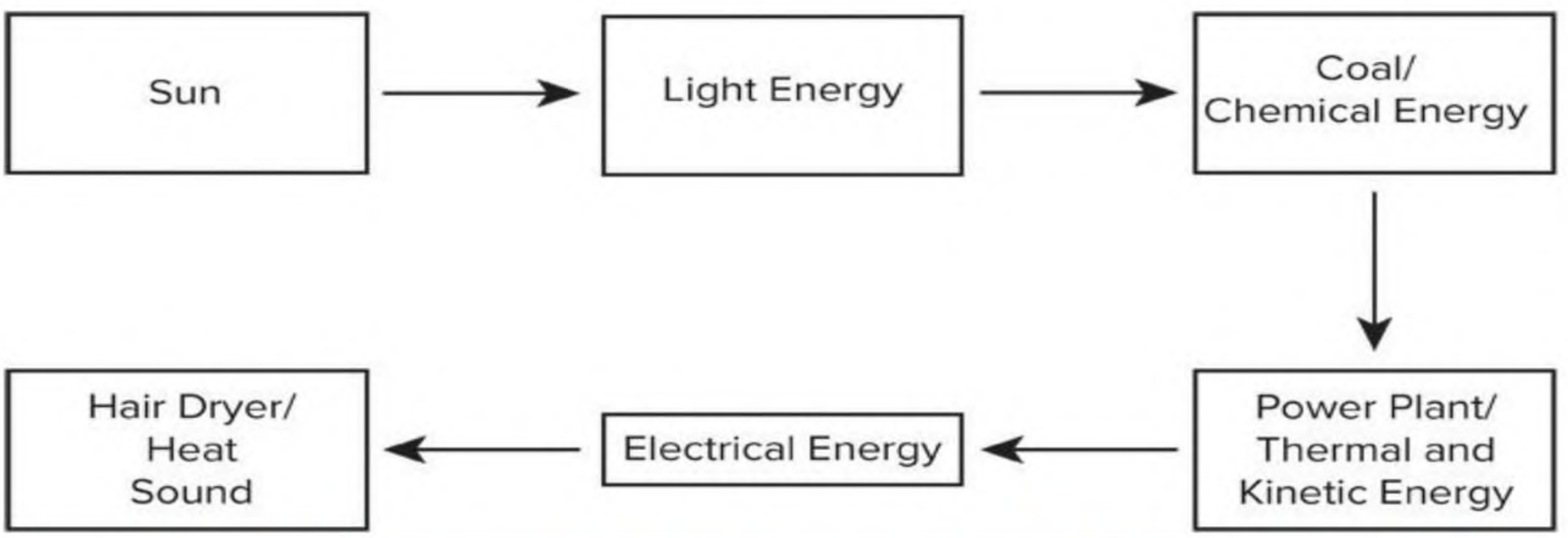
1. Sun converts nuclear energy to light energy
2. Wood/tree absorbs light energy and changes it to chemical energy.
3. firing Wood produces thermal energy
4. Thermal energy transfers from firing wood to the pot of water to heat it.

The energy chain for a hair dryer

The energy chain for a hair dryer **is more difficult**. The electrical energy that powers a hair dryer reaches it along an electric cord that is made of copper.

The electrical energy comes from a power plant of some type. Perhaps it burned **coal** or **gas** to make this electrical energy. But **where did this energy originally come from?**





A diagram shows the energy chain for movement of energy starting with sun/nuclear energy and ending with hair dryer/heat sound.

Power plants burned coal, a form of chemical energy. Coal was formed millions of years ago from dead trees. The trees have gotten their energy from sunlight.

Not all energy that enters an energy chain reaches the device and gets used as we intend. At each link in the chain, **some energy escapes as other forms**. **It still exists**, but it gets **transformed into another energy form** that is not used by the device. Most of this energy is in the form of heat.

Activity 6:

Determine energy input and output of each device

Small battery clock | Handheld fan | flashlight | Hand bell | Toy car | Lamp

Device	Function	Form (s) of energy in	Forms of Energy out
1. Lamp	Lighting	electrical	Light, thermal

Activity 7 The Conservation of Energy Law

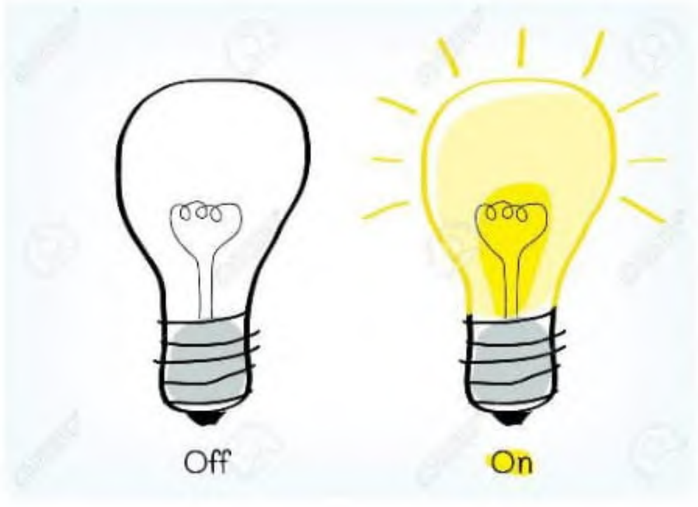
Energy is neither created nor destroyed. But it can be changed from one form to another. - Energy is never lost - Energy is changeable.

Examples of Energy changes from one form to another form

1. Turn on a light bulb, you are starting an energy transformation.

"Electrical energy that powers the light bulb is converted into light and heat energy".

If you hold your hand near some light bulbs, you can feel their heat.



It means that new energy cannot simply be made from nothing, and old energy does not disappear. Energy just changes types and forms

2. Eating breakfast (Energy conversion)

If you have ever ridden a bike, you are part of a series of events that involve energy conversion

Chemical Energy

Mechanical Energy

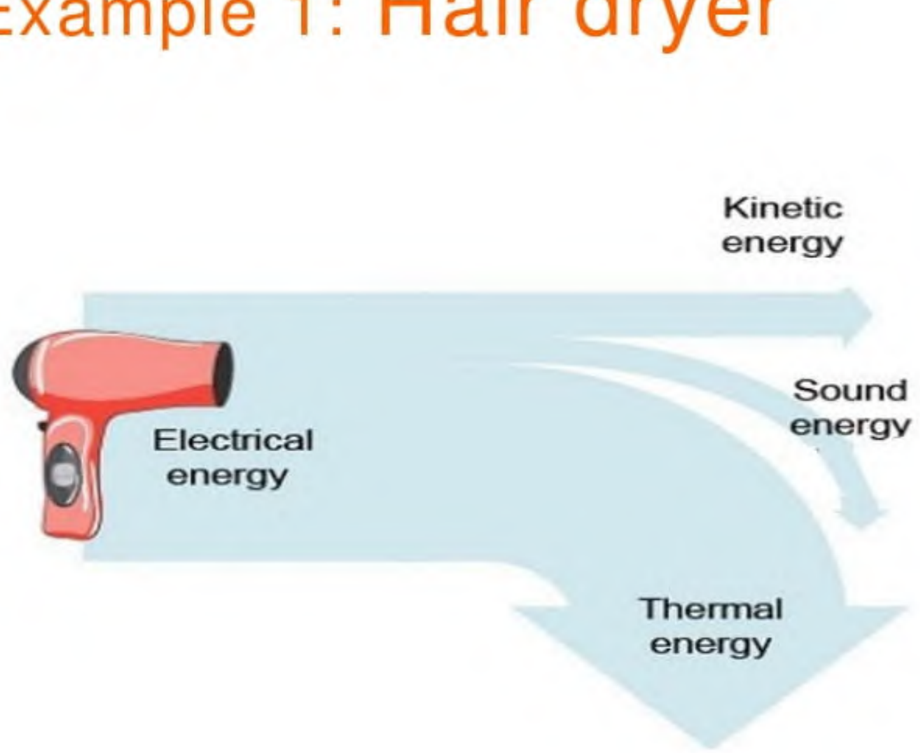
Explanation

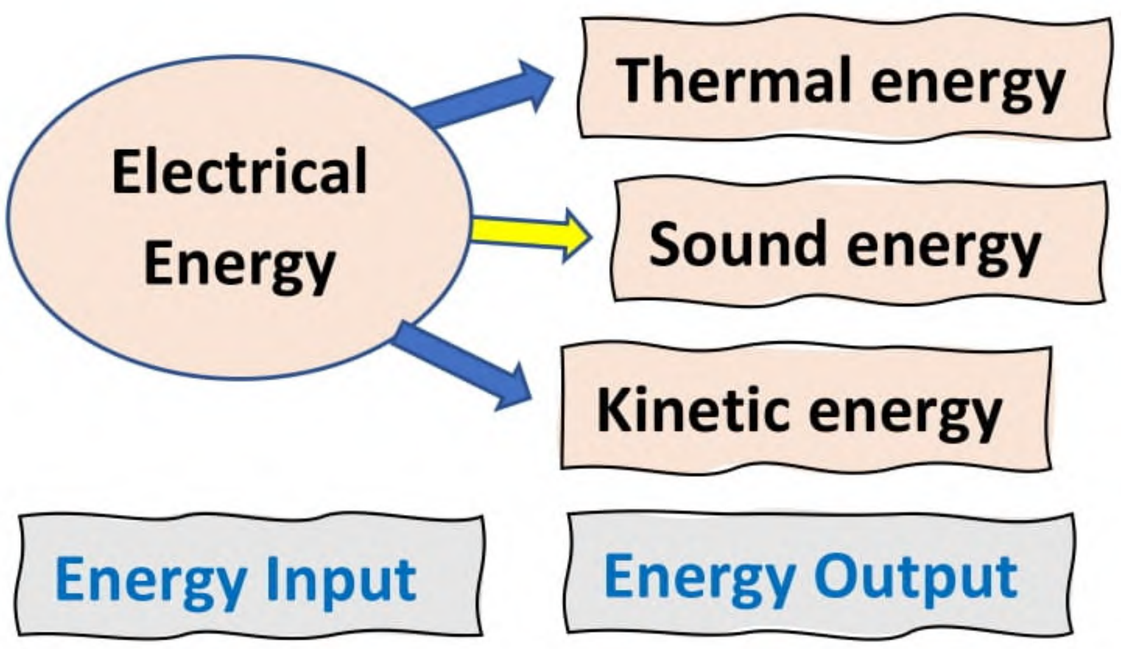
You eat breakfast so that the Chemical energy in your food will give your body energy. As you push on the bike pedals with your legs, you cause the bike to move. You are changing chemical energy into mechanical energy. The mechanical energy in the bike is also becoming heat energy as the tires rub on the road.

Activity 8: The flow of energy

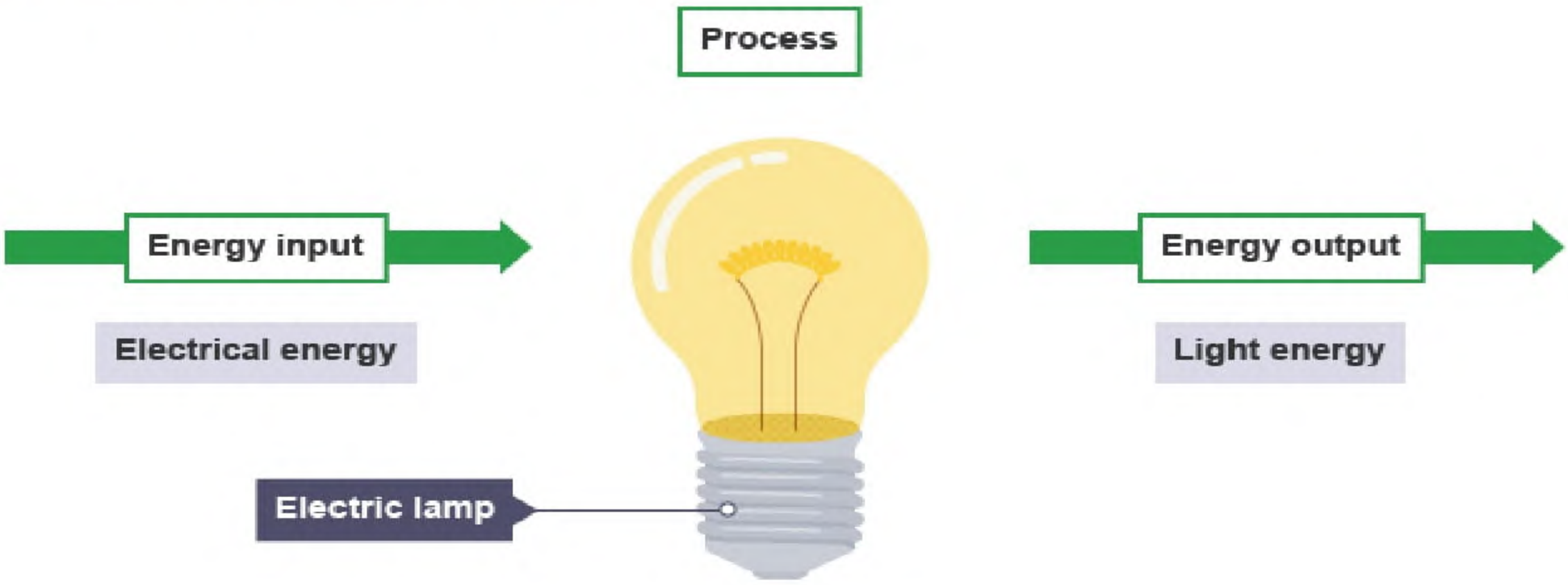
No one likes it when their cell phone battery dies. Why does this happen? Where does the energy go?

Example 1: Hair dryer

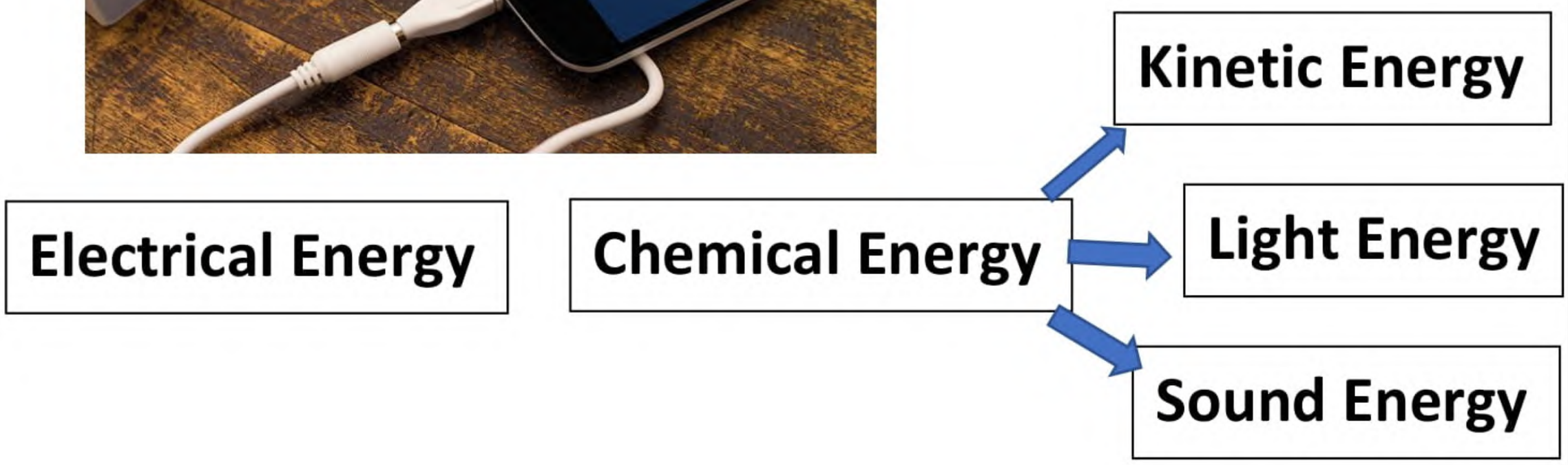




Example 2: Light bulb



Example 3: Cell phone



Energy enters the device as electrical energy. It is stored in the battery of the phone as **Chemical energy** When a phone is on or in use, the phone changes some of this stored energy. The **chemical energy** in the battery is converted into other types such as light energy, sound energy and kinetic energy when it's vibrating.

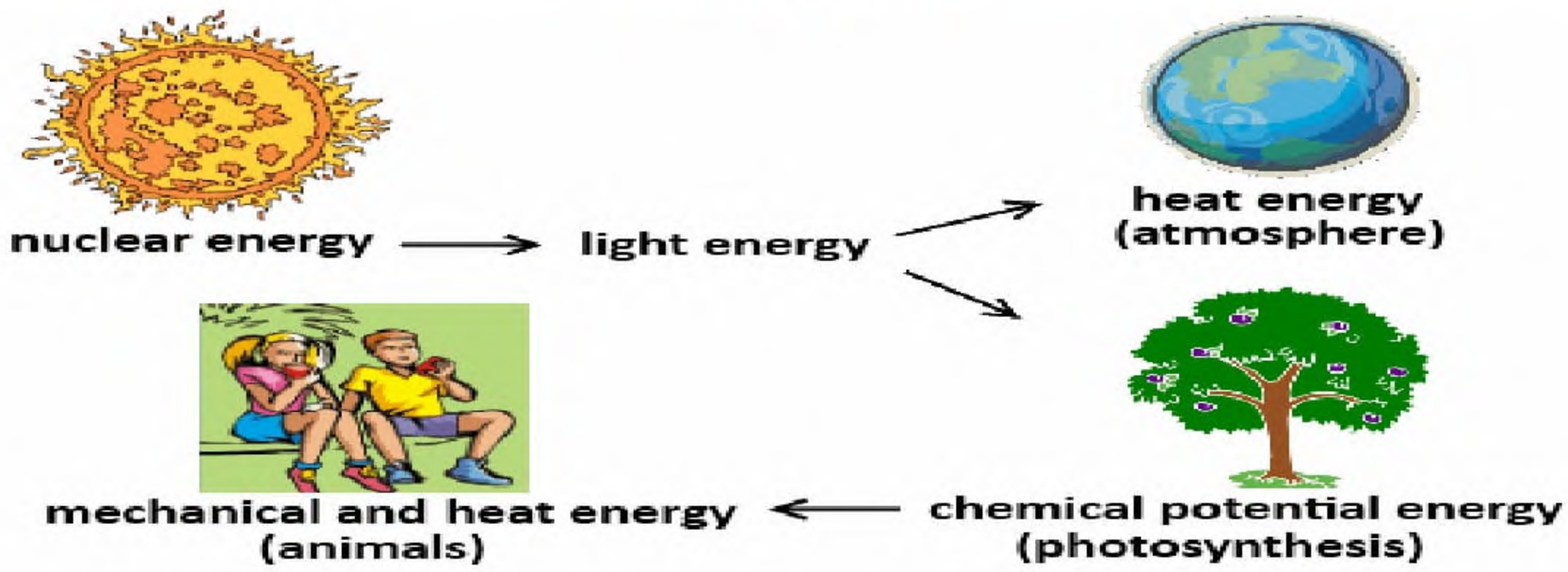
Activity 9 Build an energy chain

Energy Chain

The pathway of energy change from one form to another.

Transfer of energy from one object to another such as heat energy.

Examples



Energy from the sun is stored in the plants which are converted from light energy to chemical energy during photosynthesis process as humans and animals can get their energy to do work when they eat the plants.

Energy from the sun is stored in the tree's wood as a chemical energy to grow up, when we burn the wood produced light and heat energy to boil water or cook food.

Activity 11: Careers and Energy in Systems

Many types of scientists have careers that require knowledge of **energy** in systems such as **Ecologists** and **Engineers**.

Ecologists

1. Examine **how energy flows** through **food webs** in an ecosystem. Changes in the **flow of energy** can affect living things.

2. Some ecologists **study the movement of energy** in extreme ecosystems, such as the bottom of the ocean or the arctic.

Engineers

1. Use their understanding of energy in systems **to design technologies** that solve problems.

2. Must understand **how to design parts of a system** to change energy from one form to another.

3. For example, when designing devices like a cell phone or computer, an engineer must understand how the screen can get the energy it needs to produce a lighted display or **how sounds can be produced.**

Activity 1: where the fuel we use every day, such as in cars and trucks, comes from?

(Gas station – gasoline – fuel)

Cars and trucks need ..... as a source of energy to move.
This energy comes from.....
When the car is run out of....., we should go to gas station.

Gas from the gas station comes from oil. We dig oil out of the ground
Oil is a fossil fuel. Fossil fuels are deep in the ground. We use fossil fuels to heat our houses and to supply gas for our cars.

Activity 2: Can cars move without fuel?

When the car is running out of gas, we should go to gas station, Cars need fuel as a source of energy to move. The car burns the gas in the engine, and the engine turns the wheel.

Chemical energy → **Kinetic energy**

If there is no fuel, there is no movement.

- Scientists trying to invent cars that use clean energy sources such as solar cars. Solar vehicles can't run on solar energy because the energy we get from the sun is not as great as the energy we get from gasoline.

Activity 3: Fuels We Use

Fuel is a source of energy that has many forms and uses.

Forms of fuel

- Natural gas
- Wood
- Gasoline
- Coal

Uses of different forms of fuels

Gasoline	Natural gas	Coal	Wood
			
Running on vehicles	Used for cooking food	Cooking food and operation some trains	Warming houses

*Activity 4: **Types of fuels***

Fuel is a substance that releases thermal energy when burned

POC	1. Biofuels	2. Fossil fuels
Definition	It is a type of fuel made from plants that can be cultivated.	It is a type of fuel made from decomposition of the remains of plants and animals that lived on The Earth.
Examples	1. Wood 2. Switch grass 3. corn - Wood is the most ancient fuel and is still widely used throughout the world. - Charcoal made from wood. - Some plants can be turned into liquid fuels such as producing Ethanol from switch grass, wood chips and corn	1. Oil 2. Natural gas 3. Coal 4. Petroleum

Advantages	**1. It is a renewable source of energy** **2. Low-cost**	We use fossil fuels daily for **1.lightening houses** **2. Warming houses.** **3. Cooking.** **4. operating cars**
Disadvantages	**1. To get it requires cutting down trees.** **2. removal of forests**	**1. It is a non-renewable source of energy** **2. It causes air pollution** **3. Global warming**
Renewable or Non-renewable	**Renewable source of energy**	**Non-renewable source of energy**

Fuel can be classified into

1. Renewable sources of energy	2. Non-renewable sources of energy
They are natural materials that can be replaced soon after it is used.	**They are the natural materials that are used at a rate faster than they can be replaced.**
The biofuel such as **1. Wood** **2. Maize** **3. Weeds** **4. Charcoal** **5. Solar energy** **6. Hydroelectricity** **7. Wind energy** **8. Ethanol**	**Fossil fuels such as** **1. Coal** **2. Natural gas** **3. Gasoline** **4. Petroleum**

Renewable biofuels require careful management

1. For example, using wood as a fuel requires cutting down trees. While some trees may grow to their full height in one person's lifetime.

2.Many trees grow a few centimeters each year. This means that it would take many lifetimes for these trees to reach maturity.

3. Cutting down trees at a faster rate than they can grow leads to deforestation which has a variety of negative impacts on our environment.

Biofuel is a renewable energy?

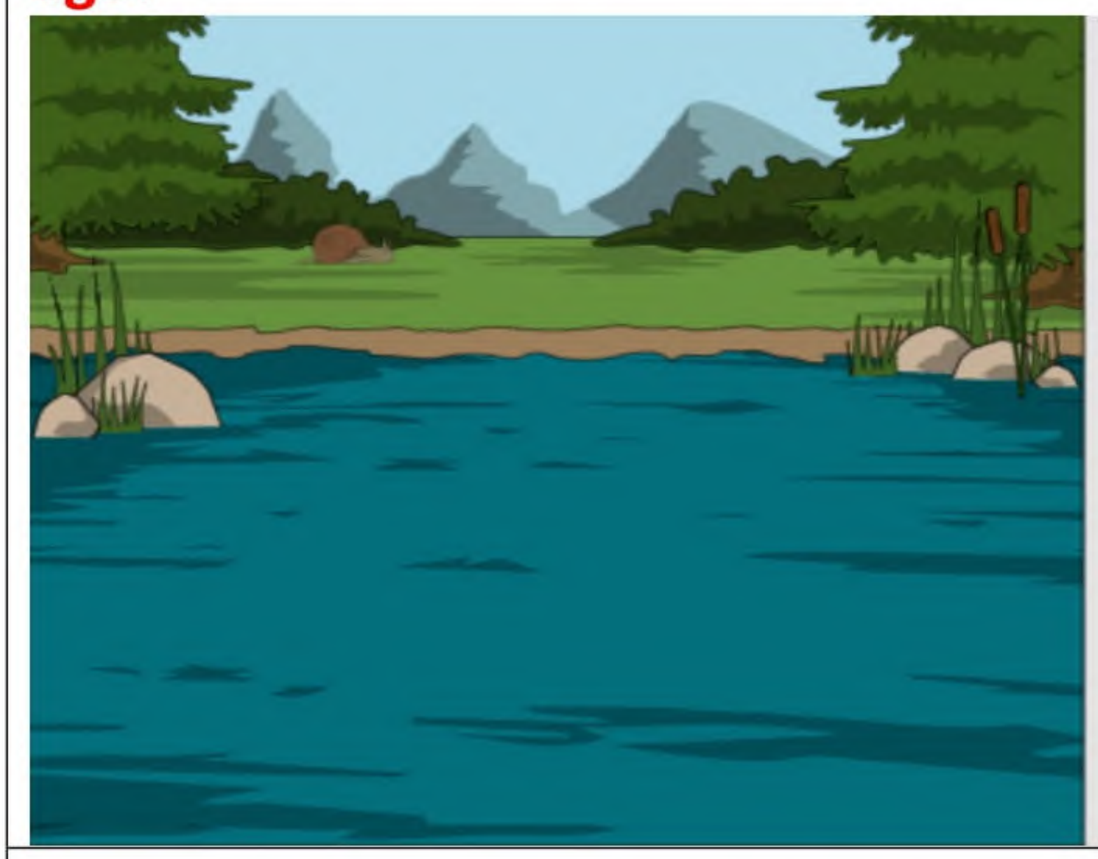
Because if we trace back to where the energy in these fuels come from, we find that they started from sun (in photosynthesis) with light energy.

Fossil fuel is a non-renewable energy?

Because once we use it, they are gone. They can't be easily renewed.

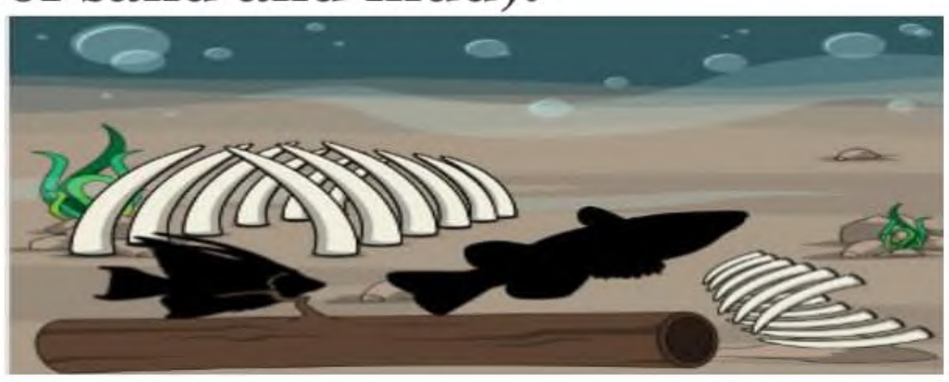
Activity 5: Formation of coal

1. Swamps exist 350 million years ago.

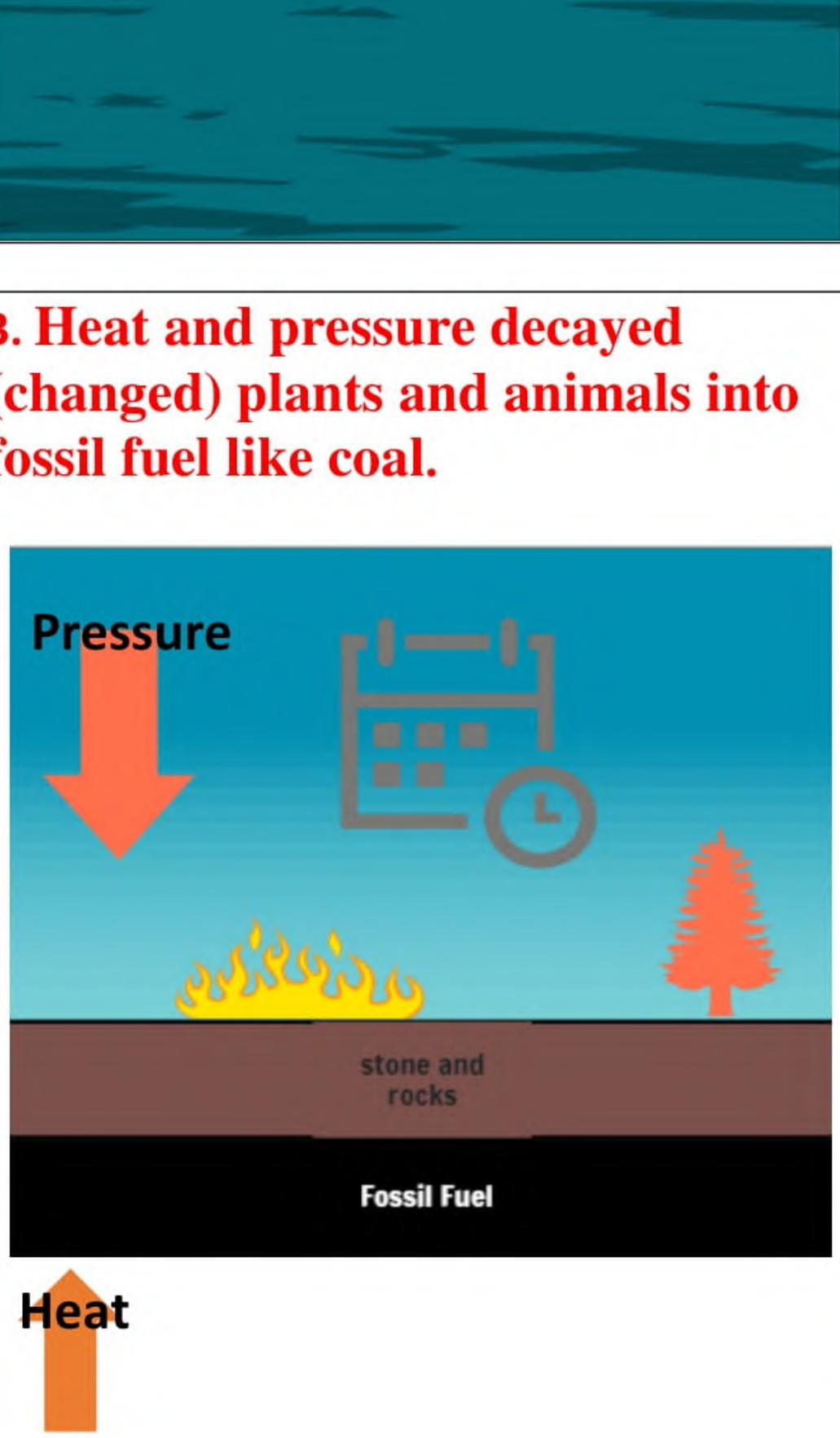


2. As living organisms died and trees fell to the bottom of these swamps and ocean where they decomposed.

Over millions of years, they buried by sediment (under Layers of sand and mud).



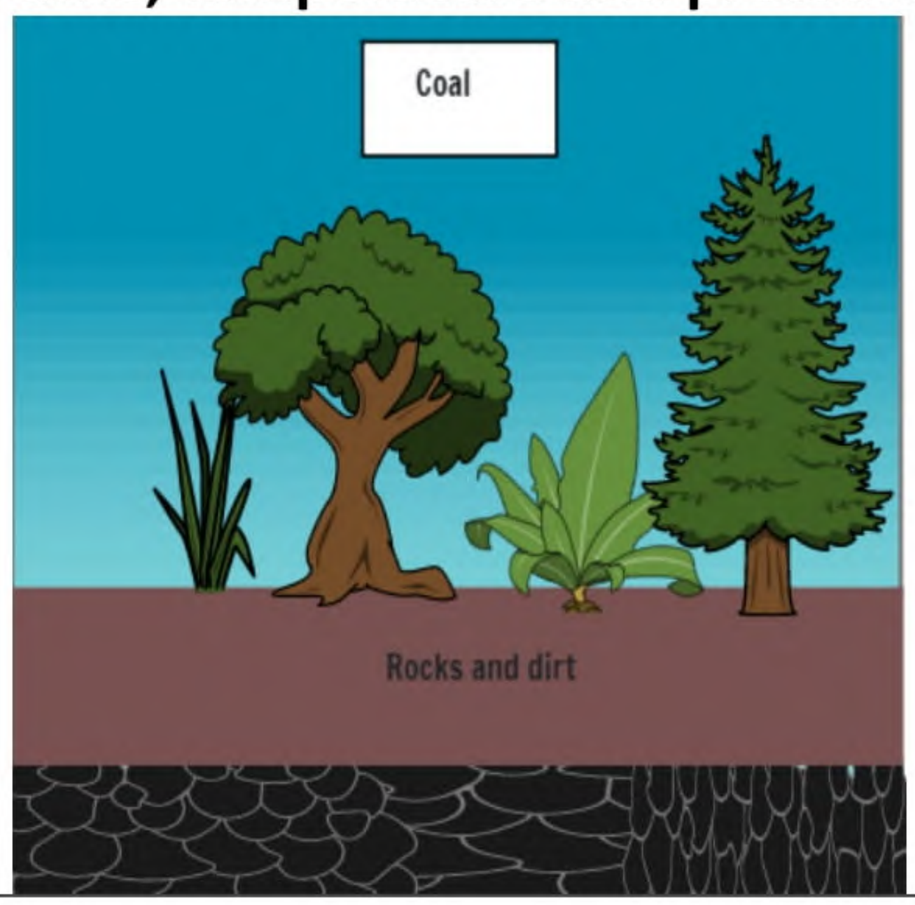
3. Heat and pressure decayed (changed) plants and animals into fossil fuel like coal.



4. Coal, oil and natural gas are formed from remains of trees and animals, heat and pressure.

Note:

The type of fossil fuel produced depend on the amount of carbon, time, temperature and pressure.



Activity 5: Oil and water: How oil is formed?

Oil and water are among the sources that human use to generate energy.

1. Petroleum Oil

Scientists believe that is formed from the decomposition of sea creatures

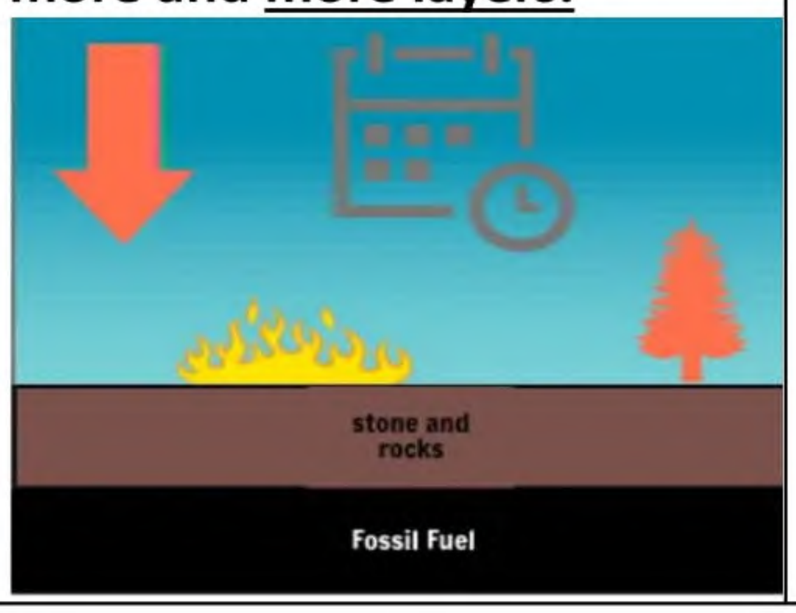
Oil is a non-renewable resource of energy.

The chemical composition of water differs from that of oil, so they don't mix

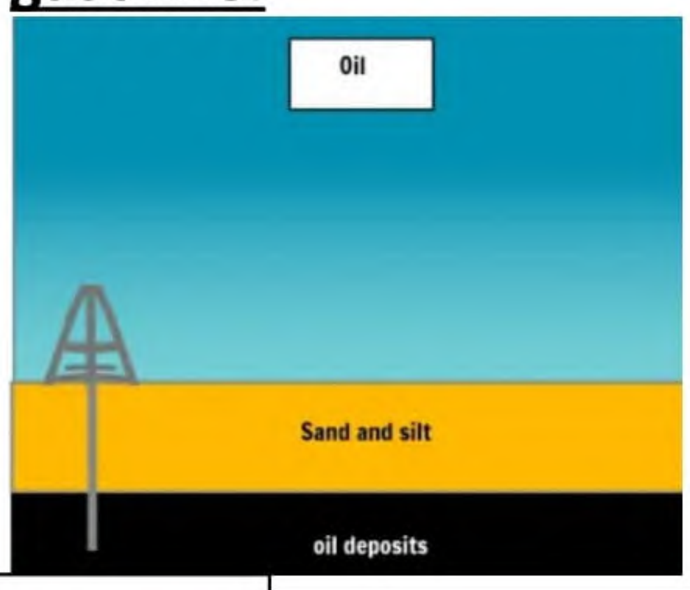
How oil is formed?

1. Oil is formed from the decomposition of sea creature, as the sea creatures' dead, their remains settled on the ocean's floor.

2. They become covered with layers of sediment and rocks, over many millions of years, the sediment and rock built up more and more layers.



3. All these layers created great heat and pressure which turned the remains into oil and gasoline.



2. Water

Water is a renewable resource of energy.

Human use water flowing to generate electricity

The differences and similarities between water and oil

	Water	Oil
Differences	It is from renewable sources of energy	It is from non-renewable sources of energy
Similarities	Both used for getting energy	

Nonrenewable resource	Renewable resource
Is a natural material that is used faster than it can be replaced. Such as (oil) We use oil faster that new oil can form.	Is a natural material that can be replaced soon after it is used Such as (water)

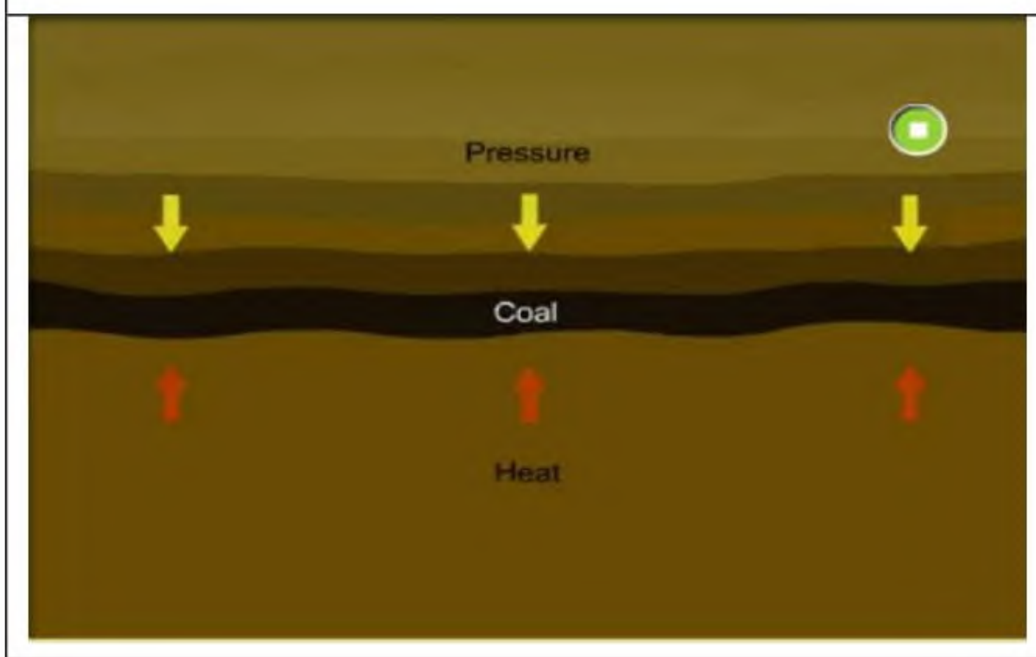
Although water is a renewable source of energy it must be used very wisely and shouldn't waste be wasted or polluted.
Water may replaced as quickly as we need it. So, we must conserve it.

The use of oil and water can be rationalized by

1. Ways to rationalize oil consumption	2. Ways to rationalize water consumption
Using public transportation instead of private cars	Growing plants that don't need irrigation water in large quantalities

Activity 7: Formation of fossil fuel

The steps involved in the formation of fossil fuels

1. the Living things that lived a long time ago	2. Remains were buried
	
3. Heat and pressure affected the remain	**4. Remains changed to become coal, oil and natural gas**
	

Activity 8: Living without electricity

it is important for everyone to understand how much electricity they use and find ways to conserve energy. In this activity, you will document your experience of spending some time without using electricity.

Document your experience

1. How long were you able to go without using electricity?

.....

2. What types of devices would you normally have used during this period of time? What did you do instead?

.....

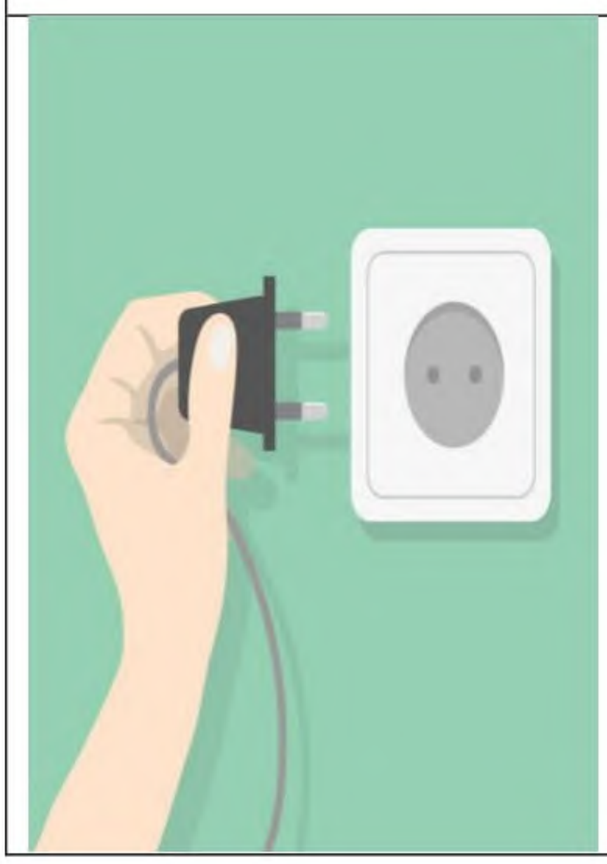
.....

3. How did you feel during and after this experience? Do you feel that you normally take electricity for granted?

.....

.....

4. What can you do at home to conserve fuels and avoid wasting electricity?

1. Unplug devices	2. Set aside regular electricity -free times	3. Turn off lights
		

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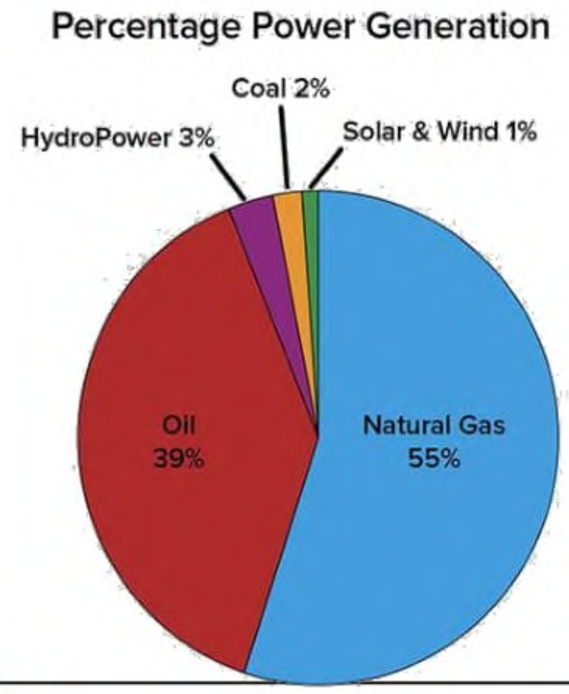
Generating Electricity Sources

Population demands and increased **industry** and **agriculture** have resulted in pollution problems around the world.

The percentage of electricity generation from different sources

1. **Natural gas and oil** produce **the greatest amount of electrical energy** in Egypt.
2. **Increasing electricity consumption** and reliance on non-renewable sources in producing electricity led to their **depletion**.
3. Therefore, it is preferable to use **renewable energy sources.**

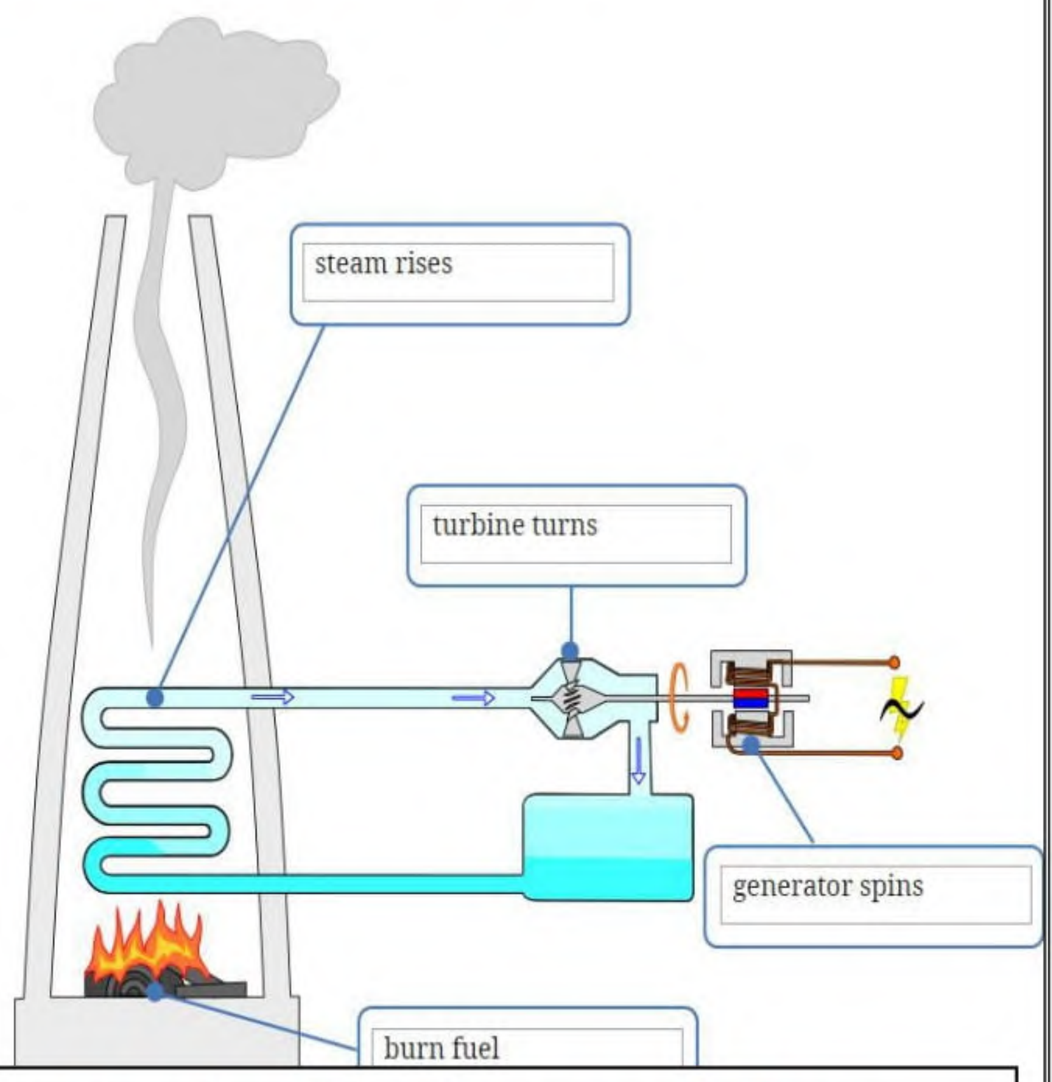


Activity 9: Using Fossil Fuels to Generate Electricity

You already know that gasoline is used to provide energy to make cars move. **But what about the electricity you use to power the lights in your home? Where does it come from? How are fuels involved in generating electricity?**

How fossils fuels are used to generate electricity.

1. Electric is generated in a **power plant.**
2. ***Oil and natural gas*** are **burned** to release **thermal energy**.
3. This is used to heat water to make **steam**.
4. The steam is used to turn a device called "turbine".
5. This **kinetic energy** is used to turn a generator.
6. A generator **transforms kinetic energy into electrical energy.**
7. The electric energy travels down wires to homes and industries.



Activity 10: Big City Environmental Concerns

- Using Fossil fuels, can have negative impacts on the environment.

The reasons of increased pollution in large cities

1. Burning fuel	2. Pesticides	3. The chemicals
		
Can pollute the air (Population demands)	used in farms (Agriculture) can be carried into stream when it rains. -Pollute water and soil.	Used in factories (Industry) lead to pollute air, water and nearby soil.

The danger of pollution

Pollution, in the forms of **runoff**, **smog**, and **ground contamination**, is especially **severe** in large cities.

Example of The negative impact of pollution on respiratory system: Smog from Automobile

1. smog from automobile **emissions (Harmful gases)** causes widespread **irritation to eyes and lungs**.

2. smog is **full of tiny particles** we breathe in irritate our **lungs** and **respiratory system**.

Activity 11: Burning fossil fuels

1. Fossil fuels include (coal – oil – natural gas).
2. Burning fossil fuels **release energy**, people use this energy to **generate electricity**, and this energy also **makes pollution and affects the environment.**

Burning of fossil fuel not only generates electricity but also causes pollution.

Burning fuel produce the carbon dioxide gas (Co2) is the main reason for the formation of acid rains and global warming phenomena on Earth.

1. Acid rains

How it forms

1. Burning fossil fuels produce harmful gas carbon dioxide (Co2).
2. Carbon dioxide combines with water vapor in the air to produce carbonic acid which cause acid rains.

Acid rains effects

1. The death of trees
2. Changing the chemical nature of lakes, which kills fish.
3. Changing the chemical nature of the soil.
4. Damage the surfaces of buildings and statues.

2. Global warming

How it forms

1. Burning fossil fuels produce a lot amount of carbon dioxide that collects in the air to form a layer in the atmosphere.
2. This layer traps heat on Earth. So, the Earth's temperature increases slowly and causing the global warming phenomena.

Global warming effects

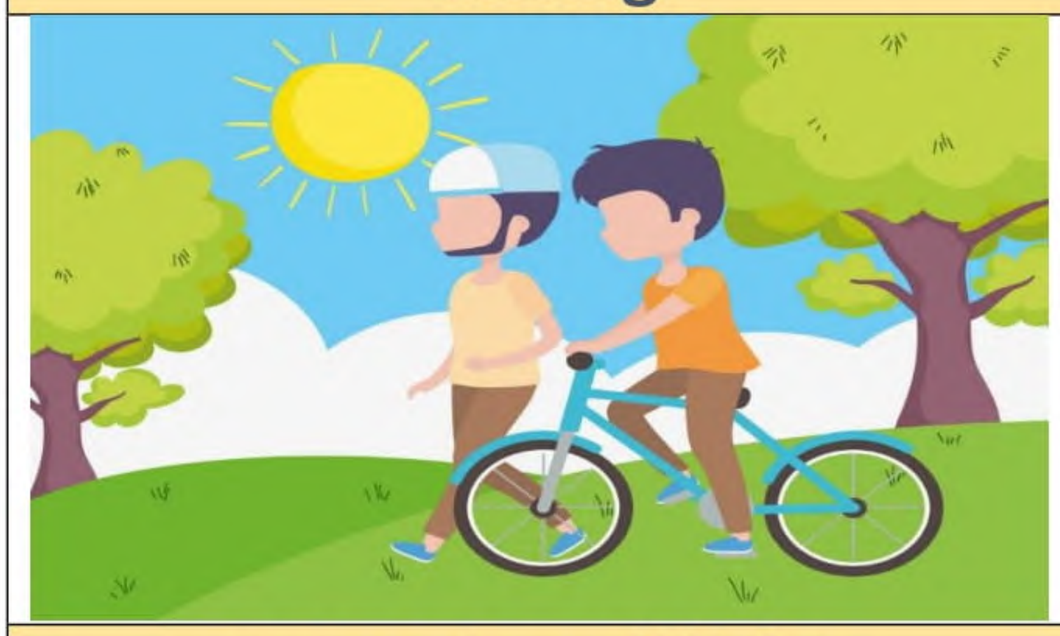
1. The Earth's temperature increases that causes death a lot of living organisms.
2. Severe weather (Reading only).
3. Sea level will rise due to the melting of ice. (Reading only)

Activity 12: conserving fossil fuels

1. There is a **limited amount** of fossil fuels on Earth.
2. Fossil fuels will **run out** because they take million of years to be formed as they can't be replaced as quickly as we use. So, we must conserve the fossil fuels.
3. There are **many ways to conserve** fossil fuels from running out.

Ways of conserving fossil fuels

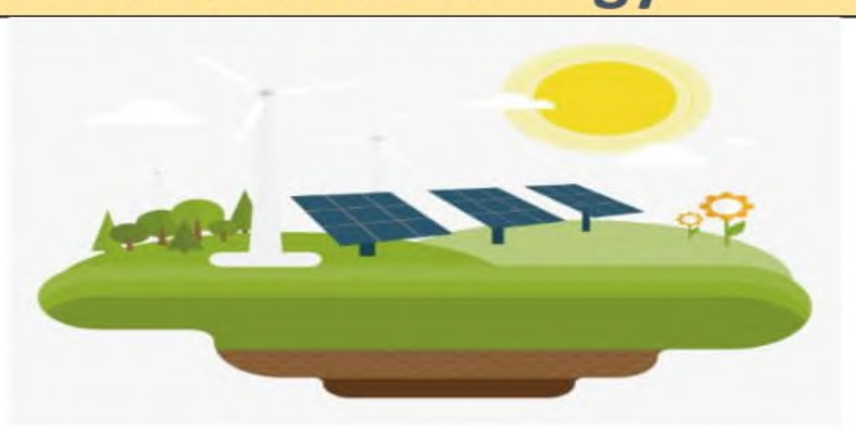
1. Walking or biking instead of driving



2. Using public transportation

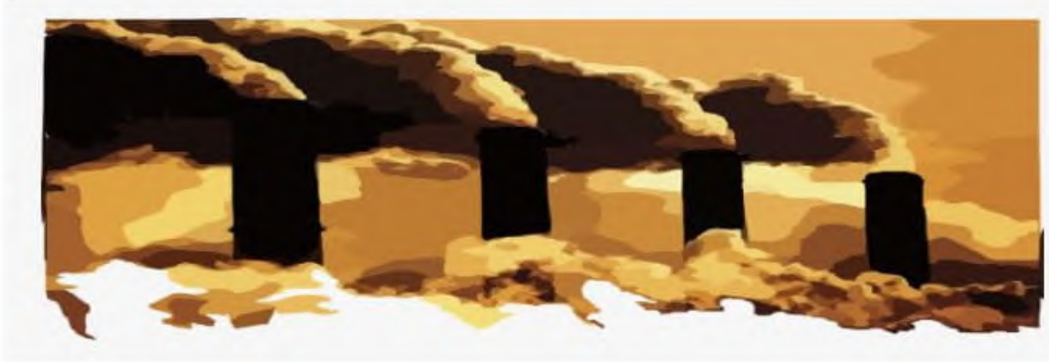
3. Turning off lights

4. Replacing fossil fuels with renewable energy



Disadvantages of fossil fuels

1. Burning fossil fuels emit (produce) harmful gases that pollute the air.



2.Burning fossil fuels cause global warming. (Increasing of the Earth's temperature)

Activity 13: Value of renewable resources of energy

1. Clean energy (don't pollute the air)

2. Renewable and don't run out.

3. Available overall the world.

4. Don't use complicated technology

5. Don't increase our Earth's temperature.

6. Don't need a high cost to repair.

7. For example, solar heaters after operating don't need repair.

Activity 14: Using Fossil Fuels

fuels can either be classified as **renewable** or **nonrenewable.**
Classify the fuels in the correct category.

Gasoline – wood – ethanol – vegetable oil – charcoal – kerosene – petroleum – natural gas – solar energy – wind – coal

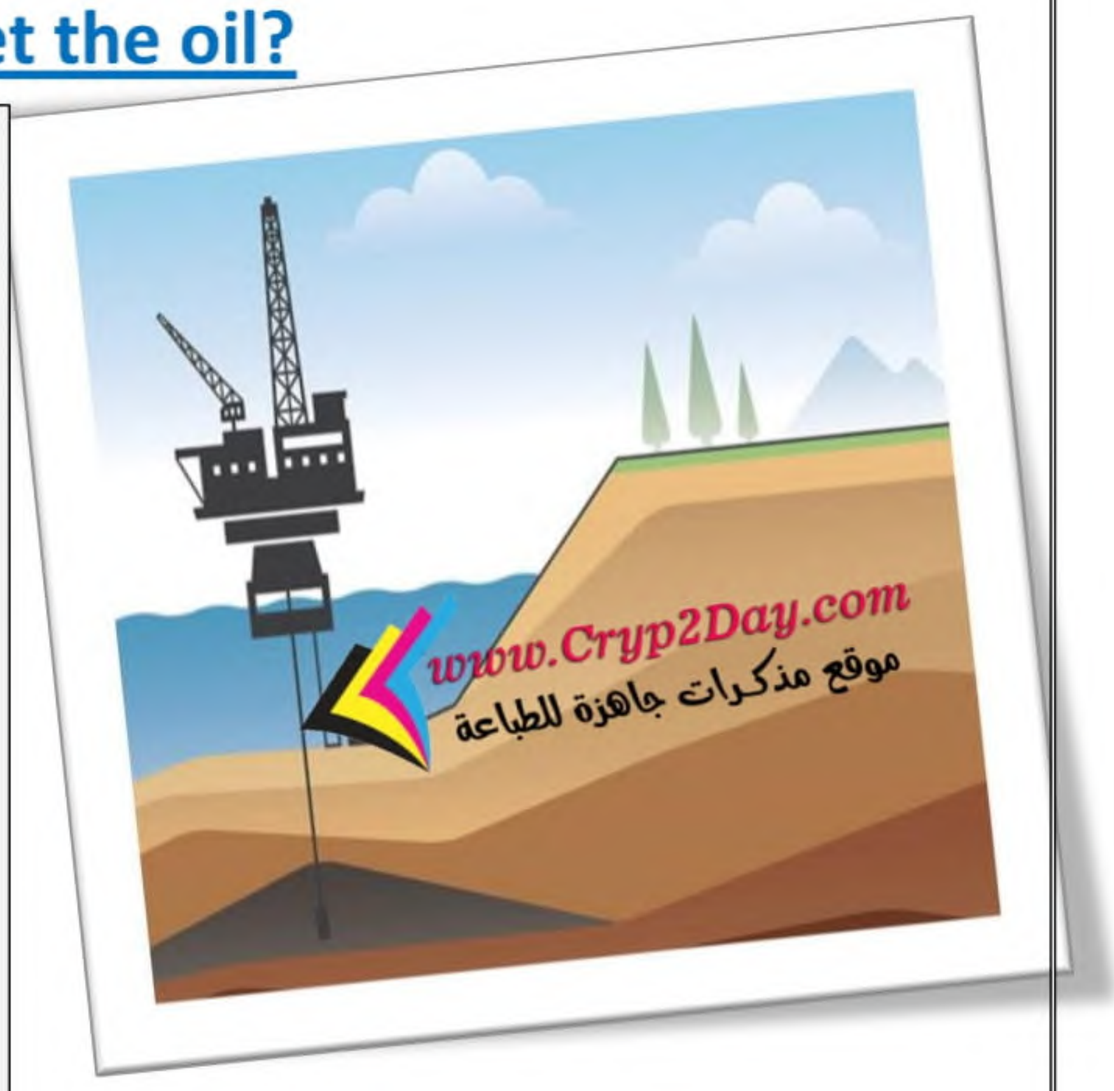
Renewable resources of energy	Non-renewable sources of energy

Renewable wood, vegetable oil, ethanol, charcoal, solar energy, and wind
nonrenewable gasoline, kerosene, petroleum, natural gas, and coal

Activity 16: Oil Drillers and Underwater Robots

How do oil drillers get the oil?

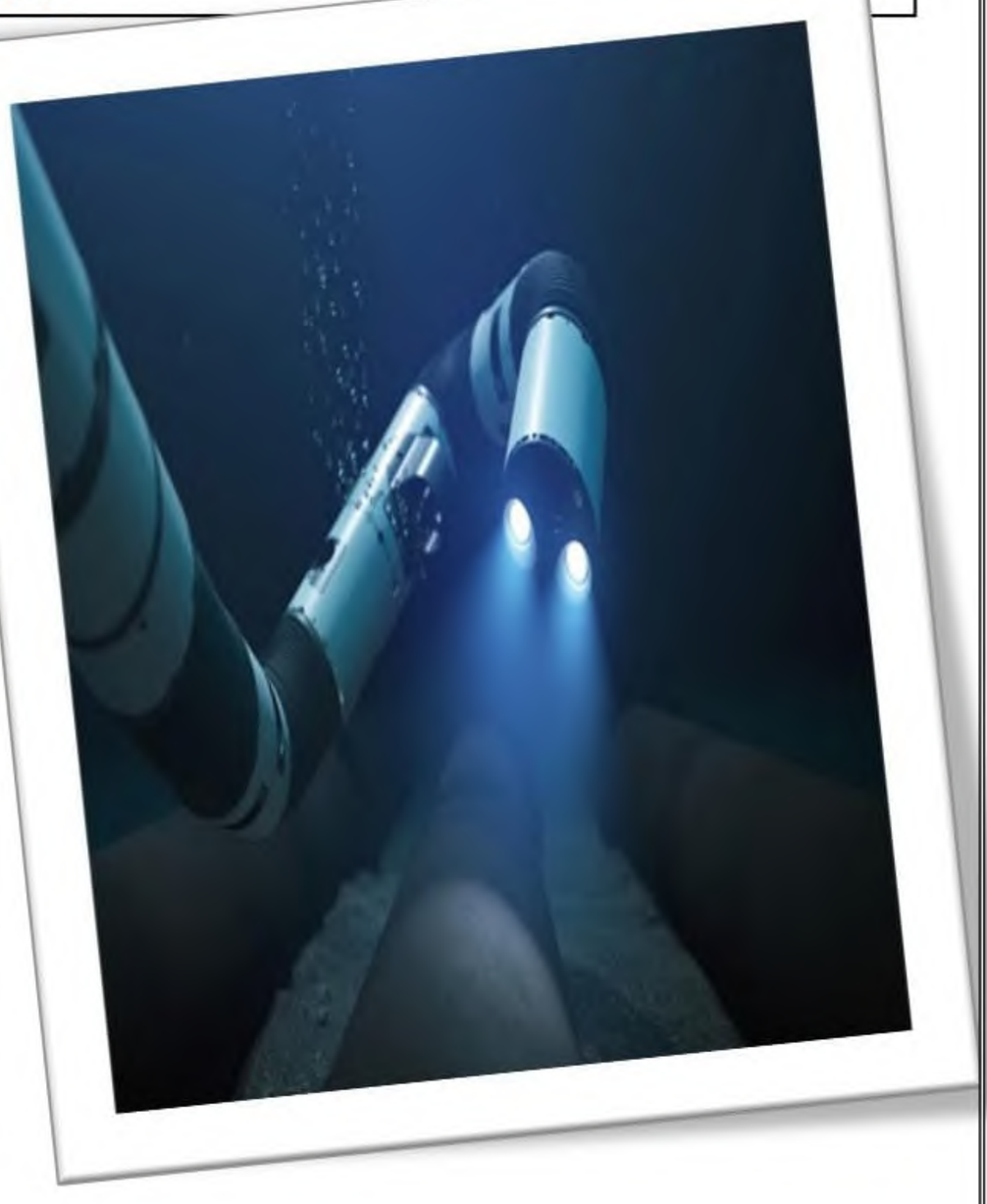
1. Oil drillers work on **oil rigs** and use special equipment to extract the oil.
2. They used **long drillers pipes** to make hole in the ocean floor.
3. Once oil drillers identify a specific location that has oil the strong drill can cut through layers of hard rocks.
4. When the drill reaches the oil, it is placed with a pump and machine that pulls the oil upward.



What are other ways can technology assist with keeping oil drillers safe?

Robot take over

- Robots can remotely controlled to adjust parts of the drilling pipes.
- They **carry video camera** that sends pictures to a computer on the oil rig.
- Robots and other technology help the oil drillers keep the oil rig, pipes and pumps working.



Oil drillers have a dangerous job. Explosion, fires, oil leak and spills, and exposure to dangerous chemicals are all possible. Thus, the use of robot and other specialized equipment that can replace human activity is very beneficial.

Renewable Energy Resources

What is the meaning of renewable energy resources?

Renewable Energy Resources	Examples
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

Renewable Energy Resources

The energy that is generated from natural processes that are not run out

1.Solar Energy

- The sun is the main source of energy for humans, plants and animals
- A vast majority of our energy on Earth comes from the sun

2. Wind Power

When the blades of a wind turbine spin, they convert wind energy to electrical energy

3. Water Power

When the blades of a water turbine spin, they convert water energy to electrical energy

4. Geothermal Energy

is heat that comes from inside Earth and used as an energy source

5. Biomass

Is made of material that comes from living organisms, used for energy like wood

What are the different ways we can use renewable energy to generate electricity?

We can generate electricity using several different renewable energy resources.

Renewable energy means that it does not run out faster than we use it.

Types of renewable energy sources are wind, water, and solar energy.

Examples:

1. Solar panels are used to power the streetlights on city roads.

1. Solar water heater	2. Solar cells	3. Solar panels
		
is a device that **converts light or solar energy to thermal energy to heat water for bath and shower.**	is a device that **converts light energy to electric energy to light house and charge devices.**	**Is a device that converts solar energy to electrical energy to power the streetlights on this city road.**

Activity 2: Windmills and Watermills

People have always used machines to make tasks easier, but we have not always had electricity to power these machines.

How do you think machines worked when there was no electricity?

Watermills	Windmills
	
Advantages	**Advantages**
-Work without electricity **- Low cost** **- Use water**	**- Work without electricity** **- Low cost** **-Use wind**
Disadvantages	**Disadvantages**
Don’t work when drought	**Don’t work without wind blow**
One of the most common jobs of **windmills** and water mills was to crush grain to make flour.	

Current wind and water turbines look both similar to and different from the windmills and **watermills** built hundreds of years ago.

Why do you think they look different?

Wind Turbines	**Windmills**
	

The similarities:

Both have blades and depend on wind blowing

1. Advantages

Get mechanical (kinetic) energy from air

Low cost and always available as a source of renewable energy

2. Disadvantages

Sometimes wind doesn't blow

The differences:

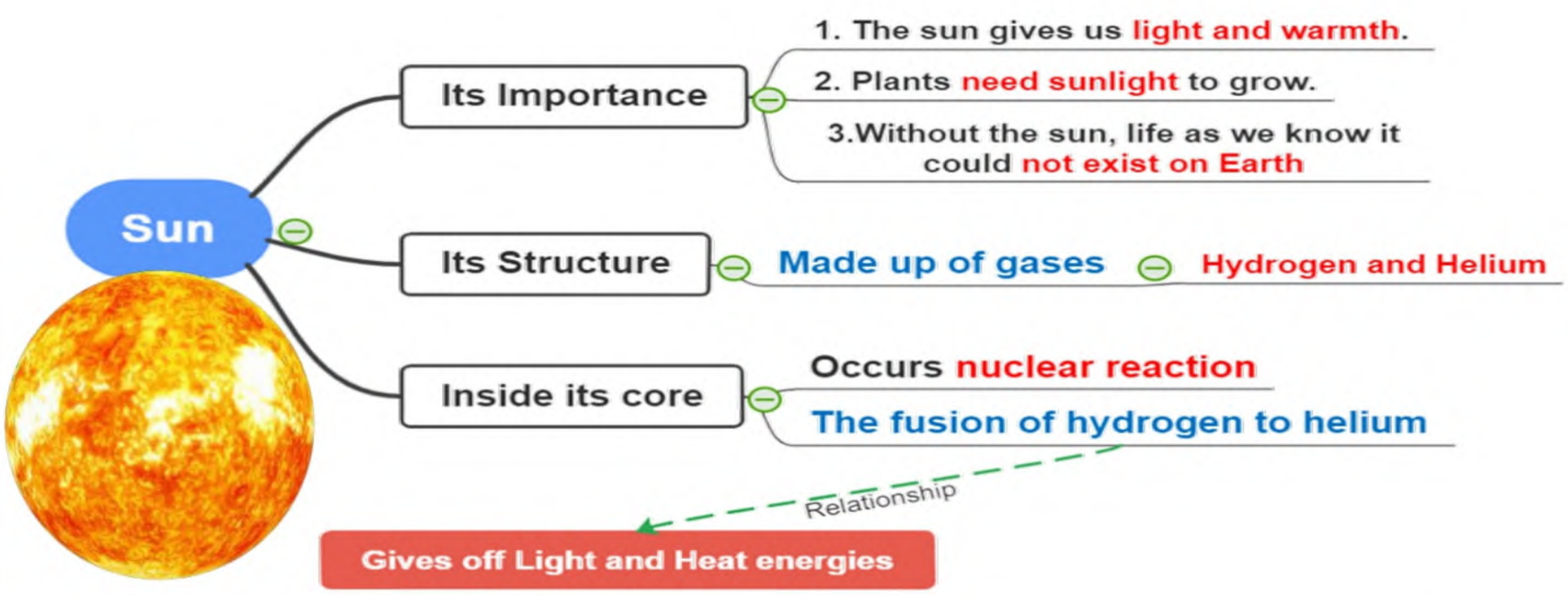
Used for generating electricity	**Used for crushing grains to make flour**
The power of Wind directly moves the internal parts of turbine to convert kinetic (mechanical) energy to electricity	**The power of wind directly moves the blades to move the internal parts of windmills to crush grains**

Activity 3: Sources of Energy, Renewable or Not?

List items you have used recently. **Record** the energy source and whether that energy source is renewable or non-renewable.

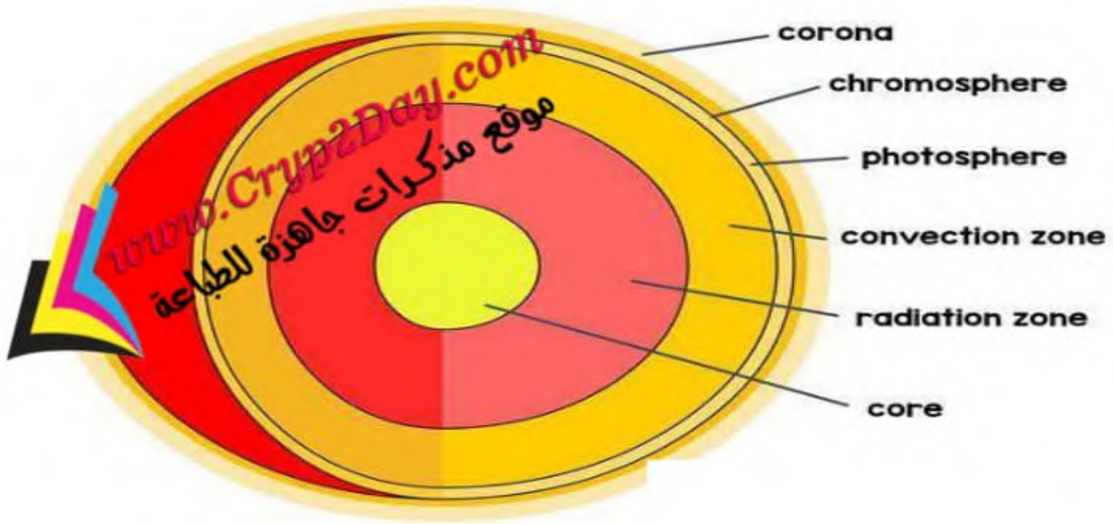
Item	Energy source	Renewable or non-renewable
Flashlight	Battery	Non-renewable
phone		
Oven		
Solar panels		
Car		
Solar water heater		

Activity 4: The sun: Have you ever wondered how the sun produces its light?



Note: the surface of sun is made up of gases. While the surface of moon is made up of solid.

the surface of sun is called the photosphere is made up of gases (Hydrogen and Helium)



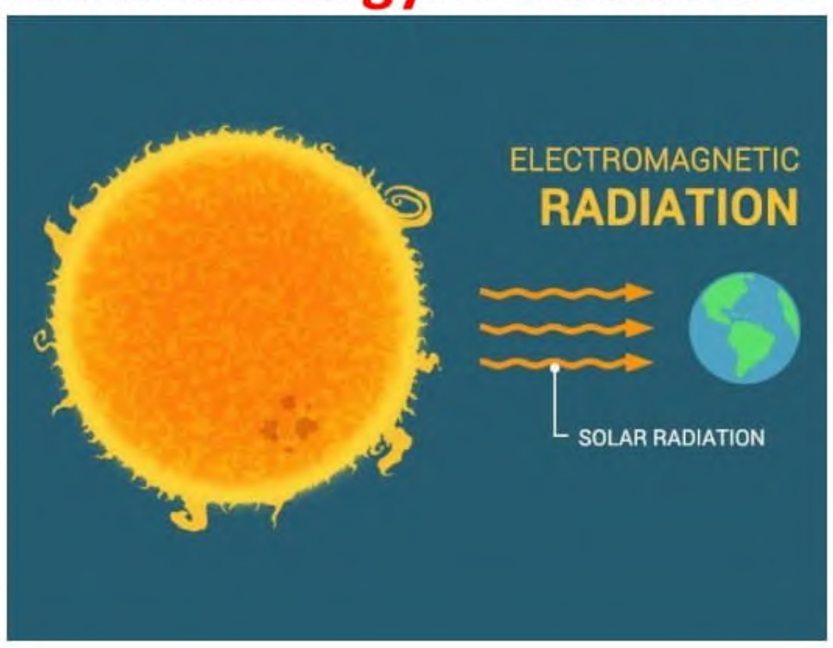
Photosphere: It is simply the region of gas on the edge of the sun that gives off light that we can see.

Activity 5: How is solar energy converted into types of energy we can use?

Using energy from the sun

- A. Feel the warmth of the sun's energy
- B. Greenhouses

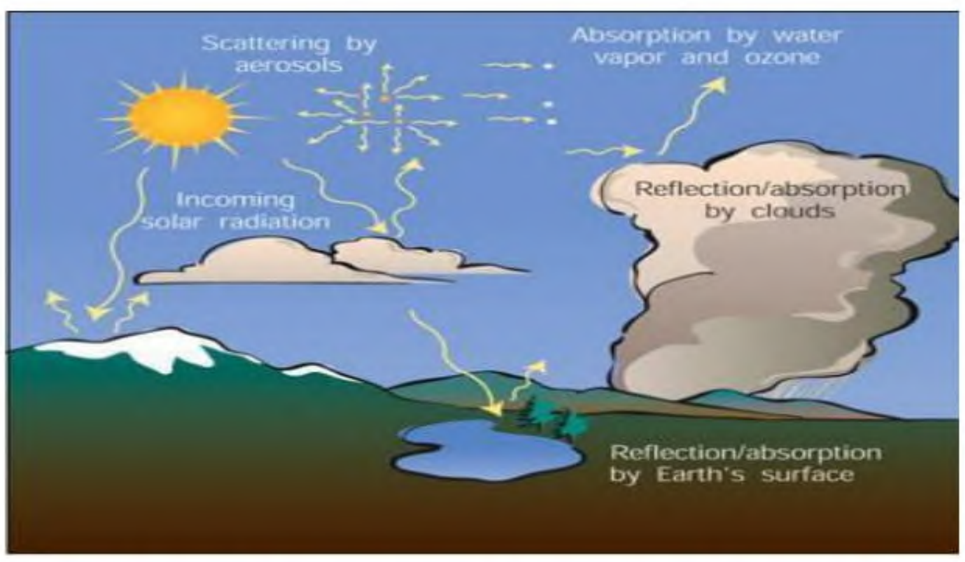
The rays that come from the sun (Sunlight) is called **radiant energy** or **Radiation**.



The energy received from the sun is called solar energy. We can use it as a thermal energy

A. Feel the warmth's of the sun's energy

The atmosphere, water, land and Earth's surface absorbed the sun's energy to increase their temperature.



C. heating water and cooking food by using curved mirror, which direct sunlight to heat the water

B. Greenhouses

1. Built in the way enables the energy from the sun such as light and radiant to warm them.

2. Done by placing glass window on the walls that faces the sun for the longest time.

3. Convert radiant energy into heat energy that warms the inside of the greenhouse.

4. Help farmers grow crops that would normally only grow in warm climates.

D. The solar heater

Heat the water as it passes through the pipes. By placing panels made of black pipes on the roofs of houses, we can store hot water (In tank) for use at another time.

Activity 6: Have you seen solar panels in your community?

Small solar panels	Large solar panels
Work as one cell only	Work In set
Supply energy to power only one streetlight	Supply energy to whole buildings or towns

Solar panels: How its work

They are made of small solar cells that catch the radiant energy of the sun and turn it directly into electricity this called solar power.

Solar panels: The importance of solar panels

The electricity that generated from solar panels can use in

Stored in batteries

Such as Solar-cell calculators run on batteries powered by small solar cells

Turn on a streetlight

The electricity can be used immediately, such as to turn on a streetlight

Houses and Buildings

use electricity made from rooftop solar panels.

Power Irrigation equipment

solar power gives farmer the energy they need to run machines that water his plants twice a day.

How does the system convert the energy from the sun?

The solar panels use metal and plastic materials to capture the sunlight and convert the sun's energy to electrical energy.

If the sun's energy is the input of the solar panel system, what is the output of the system?

The output of the solar panel system is electricity.

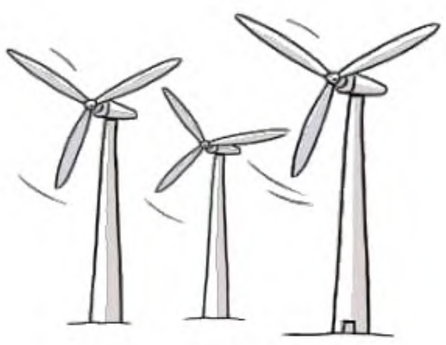
Activity 7 How wind turbines turn the **Kinetic energy** of wind into electricity?

The sun is not the only renewable source of energy.

As the sun warms Earth, it warms the air.

Different parts of the world get different amounts of this **solar energy**, which causes the air to move and wind to blow.

We can use the energy in the wind to turn the blades of **Windmills**.



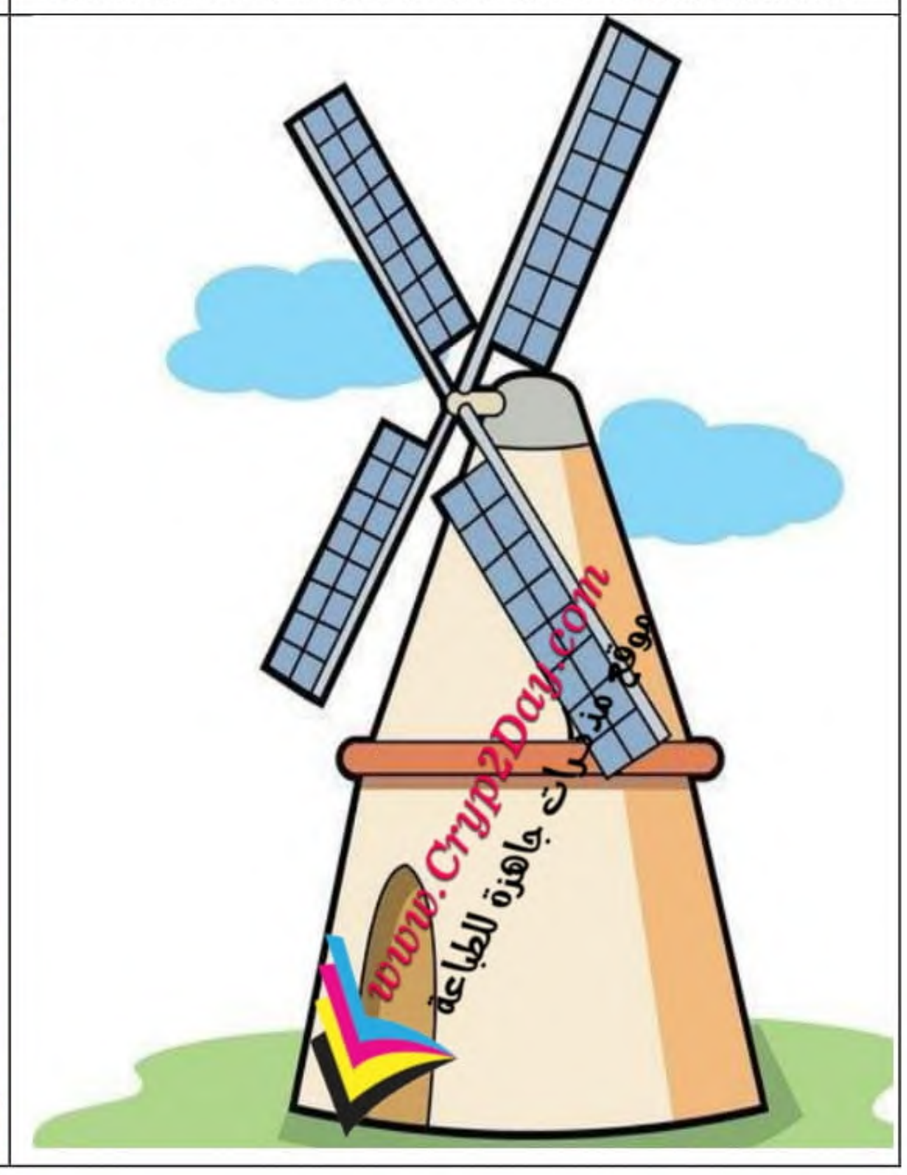
This kinetic energy can be used to generate electrical energy

The electricity from wind turbines is carried by big wires to places where it is needed.

Draw the energy chain illustrates the inputs and outputs of wind turbine

Radiant Energy	**Thermal Energy**	**Kinetic Energy**	**Electrical Energy**
Sunlight (Mechanical)	Warm and cool Air (Mechanical)	(Wind blow to turns Wind Turbine)	

Activity 8: Work as engineers to design blades for a wind turbine.

Blades of Modern Turbine Windmills	Blades of Old Turbine Windmills
	

- ***What are some of the differences you see between the two images?*** ***size, shape, number of blades, and angle.***

- ***How might the difference in the blades affect the generation of power?*** ***All the differences may affect the speed of movement of the blades.***
- ***How did the shape of the blades affect the turbine?*** ***Some shapes were able to pick up the wind easier than others. Some shapes worked better with fewer blades***
- ***What are the factors that affect the efficiency of energy transfer and transformation?*** ***Size, shape, tilt toward or away from the wind, curvature of the blade.***

Activity 9: Falling Water: Did you know water can also be used to generate electricity?

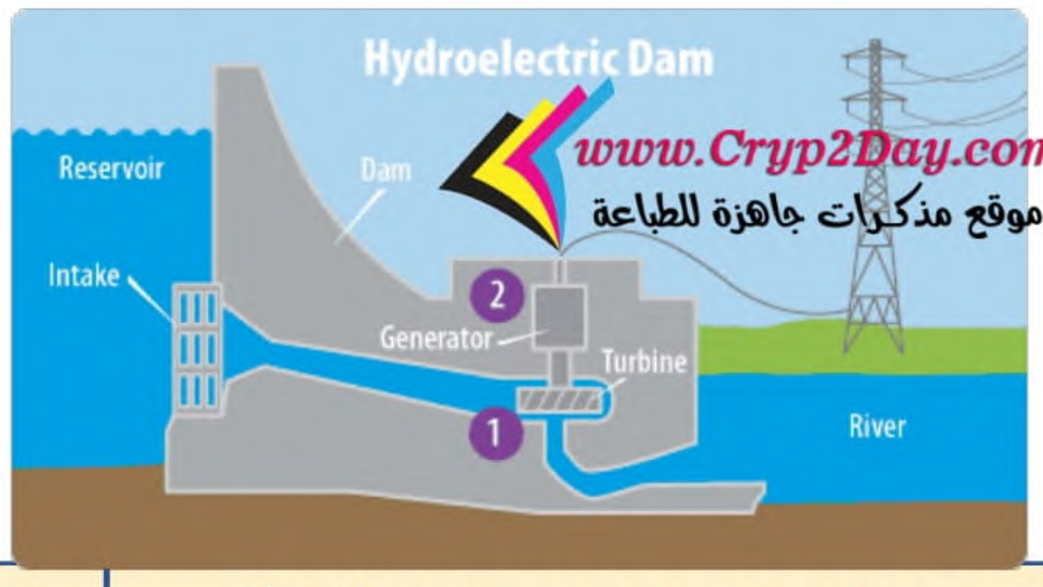
River runs downhill. As river runs, change gravitational potential energy to kinetic energy

We can use this energy to turn watermill and turbines to generate electricity

The water builds up **behind** these dams. When the water is let out, it **passes through turbines** in the dam. The water makes the turbines turn.

The turbines and generators in the dam generate **electricity**. The electricity can be sent along **wires to cities** where it is needed. This type of electricity is called **Hydroelectricity**

Hydroelectricity station



Water stored behind dam has Gravitational protentional energy	When water runs downhill through dam gravitational Potential energy changes into Kinetic energy	Flowing water turns a water turbine. A generator attached to the turbine changes kinetic energy to Electrical Energy

Complete the following

1. The use of water and wind to generate electricity is similar in depending on ..... energy.

2. The wind turbines use.....energy to generate electricity.

3. The water stored behind dam has .....Energy.

4.is considered as a source of wind energy.

5.is a tool used to control river flow.

6.are built on rivers to control water flow and generate electricity

7.are built on windy places to change the movement of wind to electricity.

Compare between Using water, wind and sun to generate electricity

	Water	Wind	Sun
Energy input:	Protentional gravitational energy	Kinetic energy	Solar Energy
Energy output	Electrical Energy		
Type of energy	Renewable Energy		
Type of Generator	Turbine as in Dams	Powers turbine	Solar cells as in Solar panels
The suitable place	Rivers	Windy places	Sunny places

Activity 10: **Modeling a Turbine Generator** **How similar do you think wind and water turbines are?** In this investigation, you will use a **pinwheel** to model a **spinning Turbine** in a hydroelectric dam.

Pinwheel as a model of a spinning turbine in a hydroelectric dam

What materials do you need?

- Large bin, at least 4L
- Water
- Large pitcher, at least 4L
- Pinwheel
- Plastic cup, 250 mL

- What Will You Do?

1.Use the materials to model a **turbine generator.**

2. When the water runs out, **use the cup** in a way that will make **the water a renewable resource** within the system.

Think About the Activity then answer the questions below: (Scan QR Code)

Q1: Explain the function of the pinwheel as a model of the hydroelectric power station. Draw **a diagram of the model with labels.**	
Q2: Describe how you changed your model so it ran on renewable energy.	
Q3: How does your solution for providing a renewable resource mimic what happens on Earth? (The water cycle)	
Q4: Which alternative energy resources come from forms of mechanical energy?	
Q5: How can mechanical energy be used to generate electricity?	

.

Note: The Similarities Between Using Water and Wind

- **Use turbine to generate electricity & renewable energy**

Activity 11: **What are the different ways we can use renewable energy to generate electricity?** **We can generate electricity using several different renewable energy resources.**

Solar Energy	Wind power	flowing water
Solar energy is a renewable energy source because it will not run out.	Wind power is also a renewable energy source that can be used to generate electricity	Flowing water is also a renewable energy source that can be used to generate electricity
1. The solar cell can produce electricity from light 2. Solar cells can be combined to produce solar panels, which can generate electricity to power various devices, cars, homes, and even airplanes. 3. Solar cells convert solar energy to electrical energy.	1. Wind turbines are devices that turn when the wind blows. 2. wind turbine is attached to a generator that can turn the kinetic energy of the moving turbine into electricity	1. Many large dams contain turbines, which are attached to generators. 2. The water flowing over the turbines operates the generators, which produce electricity. This type of power is called hydroelectric power. 3. Water is renewable because it is recycled in nature.

Explain: How people use renewable energy sources in everyday life?

.....

.....

.....

.....

.....

Activity 12: Solar Power In Space

For centuries, people around the world have burned fossil fuels for energy. However, there are many disadvantages to using fossil fuels.

Fossil fuels	
Definition	**Examples**
are made from the remains of dead plants and animals that buried deeply in earth. Humans use for getting energy	**1. Coal** **2. Natural gas** **3. Oil**
Type of energy	**Disadvantages**
Non-Renewable energy source	1. Create large amount of pollution 2. Non-renewable resource. One day we will run out of fossil fuels

The role of scientists and private companies

Teams of Scientists have been working for decades to find clean and renewable sources of energy.
Solar energy is a good source of clean, renewable energy. They have found ways to collect, concentrate and store that energy.

Scientists	Private companies
Trying to solve energy and pollution problems for their country. By replacing fossils fuels with solar energy.	**Trying to design and develop solar technologies that can meet the daily needs of both people and business**

The work of researchers making solar energy is much more available to us.

Portable form	Flexible forms of solar cells
Examples backpacks with built-in solar panels. 	Some areas, houses and even large office buildings are powered by solar energy. 
Advantages People can **charge small and personal devices** while	**Advantages** **They are smaller, cheaper and more flexible.**

they are walking or biking from place to another. **The purpose:** to charge phones, tablets and laptops.	**The purpose:** To power light house and devices.

How the astronauts on **the International Space Station** use solar energy to power their electrical systems?

Astronauts are using **solar arrays (panels)** made of **solar cells to power their electronic tools** on the space station. When the station in sunlight the solar arrays (panels) produced about **60% power** more than they need **during the daytime**.

Extra power goes directly **to charging lithium batteries**. **batteries** are essential to provide them with **power they need at night.**

At night they need power **16 times** they need per day.

The solar arrays **can produce enough to power 40 homes**
They can maximize the power generate.
They can send the **space electric power** to Earth but it is **very expensive**.

Some countries are planning to launch solar arrays to space by 2035 **to generate huge amount of clean electricity**.